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MINERAL LAND CLASSIFICATION OF THE GREATER LOS ANGELES AREA

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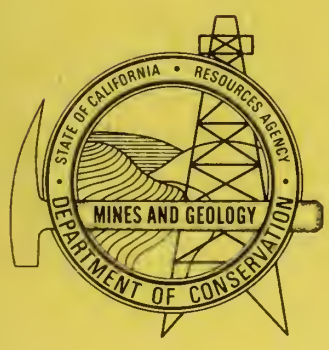
CALIFORNIA DEPARTMENT OF CONSERVATION
DIVISION OF MINES AND GEOLOGY

SPECIAL REPORT 143

Part V

Classification of
Sand and Gravel Resource Areas

**SAUGUS-NEWHALL
PRODUCTION-CONSUMPTION REGION
AND
PALMDALE
PRODUCTION-CONSUMPTION REGION**



THE RESOURCES AGENCY
GORDON K. VAN VLECK
SECRETARY FOR RESOURCES

STATE OF CALIFORNIA
GEORGE DEUKMEJIAN
GOVERNOR

DEPARTMENT OF CONSERVATION
RANDALL M. WARD
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JAMES F. DAVIS
STATE GEOLOGIST

SPECIAL REPORT 143
MINERAL LAND CLASSIFICATION
OF THE GREATER LOS ANGELES AREA

Part V

Classification of Sand and Gravel Resource Areas,
Saugus-Newhall Production-Consumption Region,
and Palmdale Production-Consumption Region

By


Stephen E. Joseph, Russell V. Miller, Siang S. Tan,
and Roy W. Goodman

With the Assistance of Thomas P. Anderson, David R. Fuller,
and Edmund W. Kiessling

Under the Direction of James F. Davis, Rudolph G. Strand,
and David J. Beeby

1987

CALIFORNIA DEPARTMENT OF CONSERVATION
DIVISION OF MINES AND GEOLOGY
1416 Ninth Street, Room 1341
Sacramento, California 95814



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PREFACE

The Los Angeles metropolitan area, with a population of nearly 10 million people, is the largest urbanized area in California. This region includes the southern part of Los Angeles County and parts of San Bernardino, Riverside, and Orange counties. Although substantial parts of the Los Angeles area have been developed, wide-spread urbanization is still occurring at a rapid rate.

In any metropolitan or rural region undergoing urban development, it is of considerable importance that adequate supplies of mineral commodities be readily available. Minerals used in construction, particularly sand, gravel, or stone used in concrete, should be available from the region in sufficient quantities to assure reasonable costs. For many years, the Los Angeles area has been fortunate in this respect: adequate quantities of low-cost aggregate materials, chiefly sand and gravel, have been available locally. However, as more and more land in a region becomes urbanized, nearby sand and gravel deposits suitable as sources of low-cost aggregate tend either to be depleted by mining or lost to competing land uses.

The principal objective of this project is to classify land in the Los Angeles area into Mineral Resource Zones (MRZs) based on guidelines adopted by the California State Mining and Geology Board. This classification project will assist the Board in the designation of lands containing regionally significant aggregate resources pursuant to the Surface Mining and Reclamation Act of 1975.

Classification information will be submitted to the State Mining and Geology Board in seven parts. An introductory section describing the background, purpose, and scope of the overall project, five sections on the classification of individual production-consumption regions, and one section on the remaining two production-consumption regions are being published as they are completed as parts of Division of Mines and Geology Special Report 143. Each of the six parts classifying production-consumption regions will include maps showing the locations of significant sand and gravel deposits and explanatory text with tables and charts that present data on population, production, aggregate consumption, future requirements, and estimates of aggregate resources.

Part I, the introductory section, and Part II of Special Report 143, which explains the classification of sand and gravel resource areas in the San Fernando Valley Production-Consumption Region, were published in a single volume. Part I has also been published as a separate volume. The present volume, which focuses on the classification of sand and gravel resource areas in the Saugus-Newhall and Palmdale Production-Consumption regions, is Part V of Special Report 143.

The reader may wish to refer to "Aggregates in the Greater Los Angeles Area," California Division of Mines and Geology Special Report 139, which describes and evaluates the significance, uses, prices, marketing, transportation, supply, and other factors that relate to the aggregate industry of the greater Los Angeles metropolitan area.

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EXECUTIVE SUMMARY

The Saugus-Newhall Production-Consumption (P-C) Region and the Palmdale P-C Region are situated in the northern part of Los Angeles County. The Saugus-Newhall P-C Region includes the upper Santa Clara River Valley and a large area in the hills to the north, a total of 651 square miles. The Palmdale P-C Region encompasses the desert area of Los Angeles County north of the San Gabriel Mountains, including the communities of Palmdale and Lancaster, for a total of 1,103 square miles.

Even though the Saugus-Newhall and Palmdale P-C regions share a common border (see Figure 5.2), both P-C regions are independently significant with separate and distinct consumption areas and production districts. They are combined in this report in order to report the production figures and reserves of both P-C regions without revealing confidential company data. There are only two producers of sand and gravel in the Saugus-Newhall Region, and two large producers and one small producer in the Palmdale Region. Reporting either region's production separately would reveal confidential data to the plants in the area.

The sand and gravel resources of either region should not be considered to be readily available to the other as it is more than 30 highway miles from the Saugus-Newhall Production District to the Palmdale Production District, a distance generally exceeding the range of economic haulage in competition with local sources.

Although substantial portions of both P-C regions have not been developed, urbanization is occurring at a rapid pace. In any urban development it is important that land-use decisions be made with full recognition of the natural resources of the area. Mineral resources, including aggregate, are limited within a given region. The object of this report is to convey information concerning the aggregate resources of the Saugus-Newhall P-C Region and the Palmdale P-C Region and the expected needs of both regions for such resources in the next 50 years. For many years both areas have been fortunate to have adequate quantities of relatively low-cost aggregate materials locally available. However, as more areas become urbanized, suitable sand and gravel deposits are being lost through urban development and are being diminished yearly by mining.

This report presents a classification of the land in the Saugus-Newhall and Palmdale P-C regions by Mineral Resource Zones (MRZs) based on guidelines adopted by the California State Mining and Geology Board. This classification project will assist the Board in the designation of lands containing regionally significant aggregate resources pursuant to the Surface Mining and Reclamation Act of 1975.

The California Department of Conservation's Division of Mines and Geology has classified urbanizing lands within the Saugus-Newhall and Palmdale P-C regions according to the presence or absence of significant sand, gravel, or stone deposits that are suitable as sources of Portland cement concrete (P.C.C.) grade aggregate. If a deposit contained more than \$5 million worth (in 1978 dollars) of suitable material that could be extracted and marketed profitably under present technologic conditions, or those which could be estimated to exist in the foreseeable future, the deposit was classified MRZ-2.

The overall land classification within the Saugus-Newhall and Palmdale P-C regions is presented on a Mineral Resource Zone map that accompanies this report (Plate 5.1) and on 11 U.S. Geological Survey topographic quadrangles that cover in detail those areas classified MRZ-2 (Plates 5.2-5.12). Mineral Resource Zones were established on the basis of a sand, gravel, and stone resource appraisal which included the following actions: a study of pertinent geologic reports and maps; field investigations of outcrops and active and inactive pits; and an analysis of water-well logs and drill records. Five major areas, three within the Saugus-Newhall P-C Region and two within the Palmdale P-C Region, were determined to contain significant aggregate deposits and were classified MRZ-2. Cumulatively, the MRZ-2 areas cover 31 square miles in the Saugus-Newhall P-C Region (5% of the total classified area) and 37 square miles of the Palmdale P-C Region (3% of the total classified area). In addition, there are large areas that contain aggregate resources of unknown significance; these areas were classified MRZ-3.

In order to organize the volume calculations of the aggregate resources, the State Geologist has utilized the concept of "sectors" to identify those MRZ-2 areas that have not been urbanized. The geometrical configuration and the geologic continuity of the deposit in each sector is fairly uniform, so tonnage of the aggregate present can be calculated with some reliability. Thus, for example, sector boundaries are established between a modern stream channel and adjacent sedimentary rocks, both of which differ in geometrical configuration from one another, but both of which contain internal consistencies in shapes which make volume calculation possible.

In the Saugus-Newhall and Palmdale P-C regions, the MRZ-2 areas have been divided into five sectors, with existing land use that are compatible with mining. The sectors in Saugus-Newhall P-C Region cover 20 square miles (4% of the total classified area) and contain a total of 2,500 million tons of sand and gravel and 6,000 million tons of rock suitable for use as crushed stone aggregate. The sectors in the Palmdale P-C Region cover 35 square miles (3% of the total classified area) and contain a total of 2,200 million tons of aggregate. The sectors are shown on Plates 5.13-5.21. The identification of these resource sectors has been done to inform local lead agencies and others of aggregate resources that could be made available for mining by virtue of the present, generally undeveloped status of the land.

Reserves are aggregate materials that a sand and gravel company owns or controls, and for which it has a valid mining permit; resources are the total amount of available aggregate within an area, including any reserves. The estimated aggregate resources within the three sectors of the Saugus-Newhall P-C Region amount to 2,500 million tons of sand and gravel and 6,000 million tons of crushed aggregate. The resource totals for aggregate available from sand and gravel deposits and crushed aggregate available from rock deposits are identified separately because the two commodities are not entirely interchangeable. Within the two sectors of the Palmdale P-C Region the estimated aggregate resources amount to 2,200 million tons of sand and gravel. No crushed stone resources are proven in the Palmdale P-C Region.

Within both P-C regions, 510 million tons are identified as reserves available for mining at the end of 1981. These reserves cover only 3 square miles, which is one percent of the total classified area.

The total projected aggregate consumption to the year 2032 is estimated to be 54 million tons for the Saugus-Newhall P-C Region and 122 million tons for the Palmdale P-C Region.

Of the approximately 54 million tons of aggregate that will be needed to satisfy the local demand in the Saugus-Newhall P-C Region about 50 percent of this or 27 million tons will most likely be needed to make Portland cement concrete. About 50 percent of the 27 million tons will be coarse aggregate and a like amount will be fine aggregate. However, to achieve the appropriate ratio for aggregate of a proper size distribution for Portland cement concrete all three sectors in the Saugus-Newhall P-C Region are desirable. The amount of reserves in the Saugus-Newhall P-C Region, although confidential, is sufficient to provide for the estimated needs of the region for the next 50 years by more than seven fold. The amount of reserves in the Palmdale P-C Region, also confidential, are projected to last most of, but not all of the next 50 years.

To make the aggregate demand projections, production records and population figures were correlated for the past 22 years (1960-1981) to derive an average per capita rate of consumption. The derived rates of 10.0 tons per person per year for the Saugus-Newhall P-C Region and 12.2 tons per person per year for the Palmdale P-C Region were used along with population projections to make the estimate of total P-C region consumption for the next 50 years. Although studies relating past total population to past aggregate demand showed a low correlation in both P-C regions, the significance of total population as a factor in aggregate demand has been demonstrated in studies of other P-C regions in the Los Angeles area.

Should unforeseen events occur, such as massive urban renewal, disaster reconstruction, or major recession, the aggregate demand could change considerably. The presence of the San Andreas fault system within the Palmdale P-C Region and its proximity to the Saugus-Newhall P-C Region increases the chance for a damaging earthquake and subsequently the need for extensive amounts of aggregate for reconstruction.

Possible alternative sources of aggregate, in addition to those deposits classified MRZ-2, are present within the Saugus-Newhall and Palmdale P-C regions and in adjacent areas. Included in this group are Quaternary alluvial deposits, Tertiary sedimentary rocks, and areas underlain by crystalline rocks that are all now classified MRZ-3. Too little is known about the physical and chemical qualities of these materials to permit even crude estimates of the amount of possible resources.

It is unlikely that additional aggregate will be needed in the Saugus-Newhall Region from neighboring P-C region producers as two of the three neighboring P-C regions have projected shortfalls of aggregate reserves within the next 50 years. The Saugus-Newhall Region has sufficient reserves for the next 50 years.

As with many forecasts of economic activity, the forecasts in this report should not be viewed as offering unqualified predictions of how the future will unfold. The forecasts of this report are based on assumptions of the accuracy of the basic data, and the continuation of the development trends of the past two decades into the five decades ahead.

Assuming the correctness of our forecasts for the consumption of aggregate in the Saugus-Newhall and Palmdale P-C regions and adjacent P-C regions, the following conclusions were reached:

- The anticipated consumption of aggregate resources in the Saugus-Newhall P-C Region to the year 2032 is forecast to be 54 million tons.
- The anticipated consumption of aggregate in the Palmdale P-C Region to the year 2032 is forecast to be 122 million tons.
- Reserves in the Saugus-Newhall P-C Region are sufficient to supply the demands for the next 50 years.
- Reserves in the Palmdale P-C Region will last most of, but not all of the next 50 years.
- A combined total of 510 million tons of aggregate reserves have been identified within the Saugus-Newhall and Palmdale P-C regions. These reserves contain both alluvial and crushed rock aggregate. All of the crushed rock reserves are on the property of one producer in the Saugus-Newhall P-C Region.
- The adjacent San Fernando Valley P-C Region whose aggregate reserves are projected to be depleted in about 7 years will possibly turn increasingly to the Saugus-Newhall P-C Region as a source of aggregate. The San Fernando Valley P-C Region now consumes about 30 percent of the total production of the Saugus-Newhall P-C Region.
- The adjacent Western Ventura County P-C Region is projected to be depleted of aggregate reserves in about 10 years and may also turn to the Saugus-Newhall P-C Region as a source of aggregate, although planning in Ventura County is currently being directed toward local self-sufficiency.
- A high demand from both the San Fernando Valley and Western Ventura County P-C regions over the next 50 years could deplete the reserves of the Saugus-Newhall P-C Region before the year 2032. In such an event, additional permits to mine within MRZ-2 areas still available for mining in the Saugus-Newhall P-C Region would alleviate the problem of a shortfall in locally produced aggregate material.
- The Saugus-Newhall P-C Region contains 2,500 million tons of sand and gravel resource and 6,000 million tons of crushed rock resource for a total of 8,500 million tons.
- The Palmdale P-C Region contains 2,200 million tons of sand and gravel resource and no crushed stone resource.

CLASSIFICATION OF SAND, GRAVEL, AND CRUSHED ROCK RESOURCES, SAUGUS-NEWHALL AND PALMDALE PRODUCTION-CONSUMPTION REGIONS

INTRODUCTION

The Division of Mines and Geology (DMG) has classified urbanizing lands within the Saugus-Newhall Production-Consumption (P-C) Region and the Palmdale P-C Region according to the presence or absence of significant sand and gravel or rock deposits that are suitable as sources of Portland cement concrete aggregate. The land classification is presented in the form of Mineral Resource Zones (MRZs) - as described in Part I of this report - on both an over-all map of both P-C regions (Plate 5.1) and a set of 11 U.S. Geological Survey topographic quadrangles covering the areas classified as MRZ-2 (Plates 5.2 - 5.12). Five sectors, with existing land use that are compatible with mining, have been delineated in the MRZ-2 areas of Saugus-Newhall and Palmdale P-C regions.

The Los Angeles County boundary was used as the P-C boundary on the north and east sides of the Palmdale P-C Region because of its political implications for permitting, its approximate equidistance between the Palmdale producers and producers to the north near Mojave and to the east near Victorville, and the availability of planning information from Los Angeles County on future urban development.

In the Saugus-Newhall P-C Region, Los Angeles County is the only lead agency; in the Palmdale P-C Region the lead agencies are Los Angeles County and the incorporated cities of Lancaster and Palmdale, neither of which have any MRZ-2 or sector areas located within their city limits.

The Saugus-Newhall and Palmdale P-C regions have, at present, a total of five sand and gravel producers operating within their boundaries therefore, separate aggregate reserve totals cannot be given due to the confidentiality of the individual production figures. The two P-C regions have been combined in this report for that reason only. Otherwise, in all respects, each P-C region can be considered as being individually significant.

Population records and projections, combined with aggregate production records were used to estimate the 50-year need for aggregate. These data were compared to the currently permitted aggregate reserves and the calculated resources in the sectors, to determine potential aggregate sources to meet the 50-year need.

Several alternative sources of aggregate for both P-C regions are discussed. Similar studies have been completed for the San Fernando Valley P-C Region (adjacent to the Saugus-Newhall P-C Region on the south) and the Western Ventura County and Simi P-C regions (both adjacent to the Saugus-Newhall P-C Region on the southwest) as Part II of this report and Parts II and III of Special Report 145, respectively. Pertinent data from those two reports are included herein for comparison.



Figure 5.1 General location map of the Saugus-Newhall and Palmdale P-C regions.

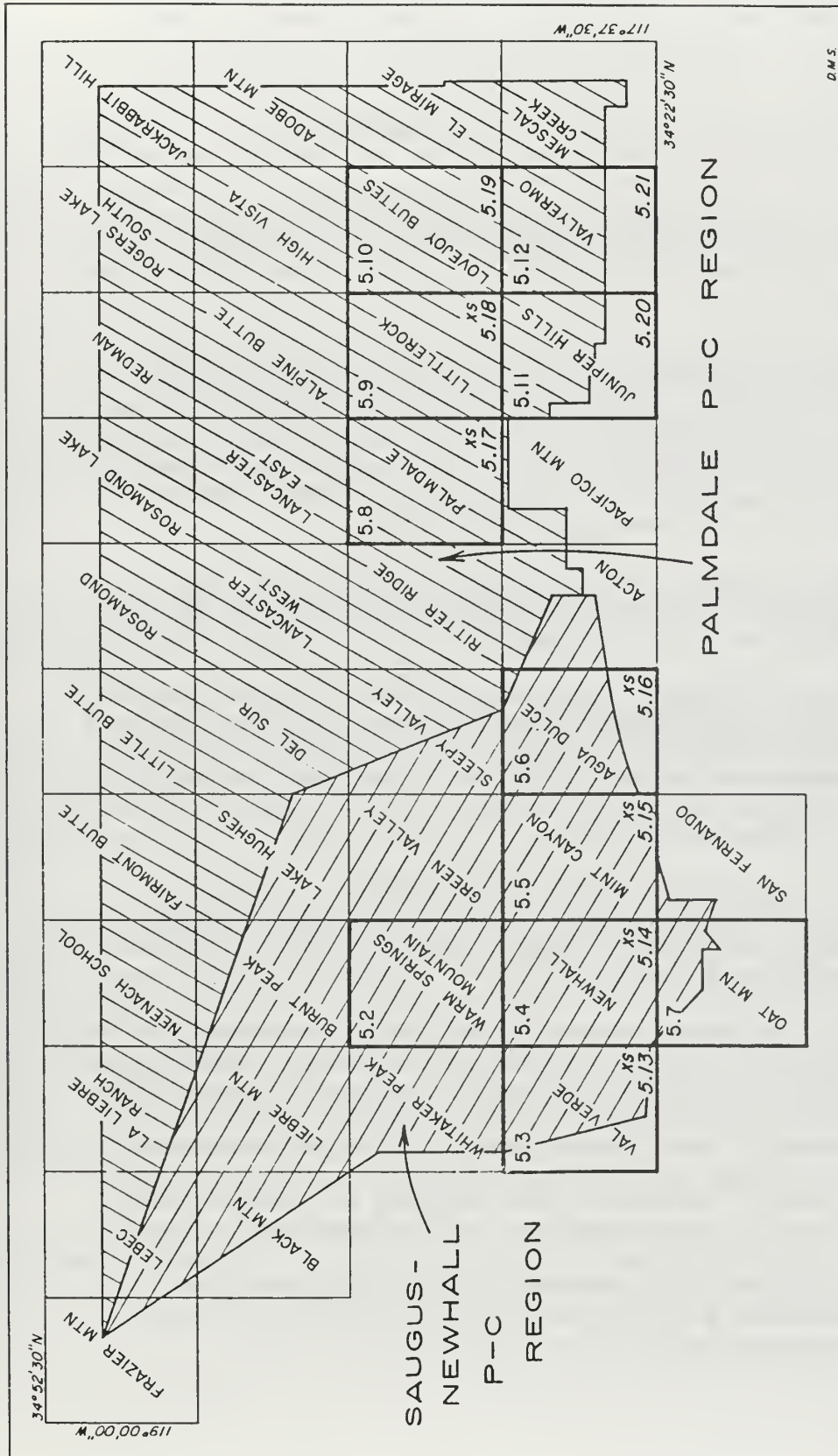


Figure 5.2 Index map of U.S. Geological Survey 7.5-minute quadrangles covering the Saugus-Newhall and Palmdale P-C Regions, the detailed Mineral Land Classification (MLC) maps (Plates 5.2 through 5.12), and the Resource Sector (RS) maps (Plates 5.13 through 5.21). The locations of the MLC and RS maps in this report are shown with heavier boundaries. The plate numbers for the corresponding MLC maps are shown with vertical numbers in the upper left-hand corners; the plate numbers for the corresponding RS maps are shown with italic numbers in the lower right-hand corners. Plates showing the location of geologic cross sections have an "XS" over the plate number.

To assist the reader, the following "road map" through this report will be helpful. The classification process, which is described more fully in Special Report 143, Part I, is separated into seven interrelated steps. Steps 1 and 2 in the following list are not described in this report, but are restated herein from Part I for completeness. Steps 3 through 7 from the bulk of this report (Part V) and are described sequentially. Resource information is integrated in Table 5.1.

The classification process can be briefly summarized in the following steps:

1. Determination of Production-Consumption (P-C) Region boundaries: In this step, active aggregate operations are identified (Production) and the market area they serve is determined (Consumption).
2. Determination of modified OPR boundaries within the P-C region: Only those portions of the P-C regions that are urbanized or urbanizing (based on determination by the State Office of Planning and Research, as modified by local lead agencies) are classified for their aggregate content. Other areas may be classified with the approval of the State Mining and Geology Board. This step determines which areas are to be classified.
3. Establishment of Mineral Resource Zones (MRZs): This step includes a geologic appraisal of aggregate deposits for all land within the modified OPR boundaries.
4. Determination of Sectors: Only those portions of land classified MRZ-2 (in Step 3) that have current land uses considered to be compatible with mining are considered to be available as future aggregate resources for the P-C regions. This step utilizes intensive field checking to determine present land uses. (See Appendix for sector criteria.)
5. Calculation of resource volumes within Sectors: In this step, careful analysis of site-specific conditions is utilized to calculate total volumes of aggregate reserves and non-permitted resources within each sector.
6. Forecasting: In this step, anticipated aggregate demand within each P-C Region for the next 50 years is estimated. This is done by correlating historic population and aggregate production data for the past 20 years to calculate an annual per capita consumption rate. This figure is used with projected population figures for the area to determine anticipated aggregate demand for the next 50 years. Results of this analysis are compared with total volumes of aggregate reserves in the respective P-C region.
7. Alternative resources: A variety of potential alternative aggregate resources are described in this final step of the classification process.

MINERAL RESOURCE ZONES

Mineral Resource Zones (as defined by the "Guidelines for Classification and Designation of Mineral Lands," in Anderson, and others 1979, Part 1, Appendix A-3, p. 43, and California State Mining and Geology Board, April 1983, p. 23) within the Saugus-Newhall and Palmdale P-C regions were established on the basis of an aggregate-resource appraisal which included: an analysis of geologic reports and maps, field investigations and examination of active sand and gravel mining operations, analyses of drill-hole data, interpretation of aerial photographs, and evaluation of private company data.

The Mineral Resource Zones depicted on Plates 5.1 through 5.12 were established based on the suitability of the deposits for use as Portland cement concrete (P.C.C.) aggregate. Lower quality aggregate resources, acceptable for use as asphaltic concrete aggregate, construction subbase, railroad ballast, etc., have not been zoned independently on the plates, but are evaluated only where they occur in conjunction with P.C.C. aggregate. They are discussed under Resource Sectors A-E.

Areas Classified MRZ-1

These are areas for which adequate information indicates that no significant aggregate deposits are present or where it is judged that little likelihood exists for their presence.

These areas occur in the mountainous areas underlain by bedrock formations in both P-C regions, and also on lowlands in the Palmdale P-C Region. Available geologic mapping and field observations indicate that these MRZ-1 areas are underlain by sedimentary deposits composed predominantly of fine-grained material unsuitable for use as P.C.C. aggregate.

The MRZ-1 areas in the Saugus-Newhall P-C area include parts of the Santa Susana Mountains, hills adjacent to San Martinez Grande Canyon (west of Castaic Junction), hills both to the east and west of Castaic Lagoon, hills adjacent to Dry Canyon Reservoir, and hills bounding Bouquet Canyon just south of Del Sur Ridge. The sedimentary rocks which are classified as MRZ-1 are siltstones, mudstones, and siliceous shales with minor amounts of sandstone and limestone of the Modelo Formation (upper Miocene); siltstones and very fine sandstones of the Pico Formation; and siltstones and mudstones of the Towsley Formation (upper Miocene and lower Pliocene).

The MRZ-1 areas within the Palmdale P-C Region are underlain by fine-grained sedimentary rocks of the San Francisquito Formation (Paleocene and Eocene), Punchbowl Formation (upper Miocene and lower Pliocene), Anaverde Formation (Pliocene), Juniper Hills Formation (Pliocene), Harold Formation (Pleistocene), and other Pleistocene deposits (such as the lacustrine sediments in the Rosamond Lake vicinity) and Holocene lake sediments.

Areas Classified MRZ-2

Three areas of differing geologic terranes within the Saugus-Newhall P-C Region and two areas of similar geologic terrane within the Palmdale P-C area have been classified MRZ-2 (Plates 5.1 - 5.12). These are areas where adequate information indicates that significant mineral deposits are present or where it is judged that a high likelihood for their presence exists ("Guidelines for Classification and Designation of Mineral Lands," in Anderson, and others, 1979, Appendix A-3, p. 43).

To arrive at a judgment that a high likelihood exists for the presence of significant mineral deposits, the geologic factors that resulted in the formation of the deposit must be understood clearly enough so that reasonable subsurface interpretation can be made from surface exposure of the material and from drill-hole data.

The deposits within the Saugus-Newhall P-C Region that satisfy these criteria are certain bedrock units of the Mint Canyon Formation, the Precambrian anorthosite-gabbro group and portions of the Santa Clara River Valley flood plain (Plates 5.2-5.7). Portions of these deposits are currently being mined and processed for aggregate uses (Figure 5.3). Within the Palmdale P-C area, two large Holocene alluvial fans are classified as MRZ-2 areas (Plates 5.8 - 5.12).

Several different companies have mined aggregate within these areas for many years. Presently, there are two companies producing aggregate within the Saugus-Newhall P-C area and three companies in the Palmdale P-C Region. About 12 miles east of the City of Saugus aggregate is extracted from the basal conglomerate of the Mint Canyon Formation by both the Curtis Company and the P.W. Gillibrand Company. The P.W. Gillibrand Company also extracts aggregate from the anorthosite-gabbro basement rock for crushed stone. At Lang Siding the Curtis Company extracts aggregate (mainly sand) from the Santa Clara River.

In the Palmdale P-C Region, the Conrock Company and Antelope Valley Aggregates, Inc. mine and extract the Holocene fan deposits of the Little Rock Wash. In September 1982, production from a previously abandoned mining pit was resumed by the Arrow Sand and Gravel Company. The Little Rock Creek fan is located about 7 miles east of the City of Palmdale and 13 miles southeast of the City of Lancaster. The Holocene fan deposits of the Big Rock Wash have been extracted in the past from a pit located about 8 miles east of Little Rock Wash.

Saugus-Newhall P-C Region

Santa Clara River Valley. The Santa Clara River flows from near Soledad Pass, east of the Saugus-Newhall P-C Region, into Ventura County. A number of tributary streams join the Santa Clara River within the region; the most significant of these are Castaic Creek, Newhall Creek, Bouquet Canyon, and Sand Canyon. Detritus that has been transported by the river and its tributaries has been deposited along the Santa Clara River channel and on the adjacent flood plain to form a 15-mile long linear deposit ranging from 500 to 6,000 feet wide and up to 80 feet

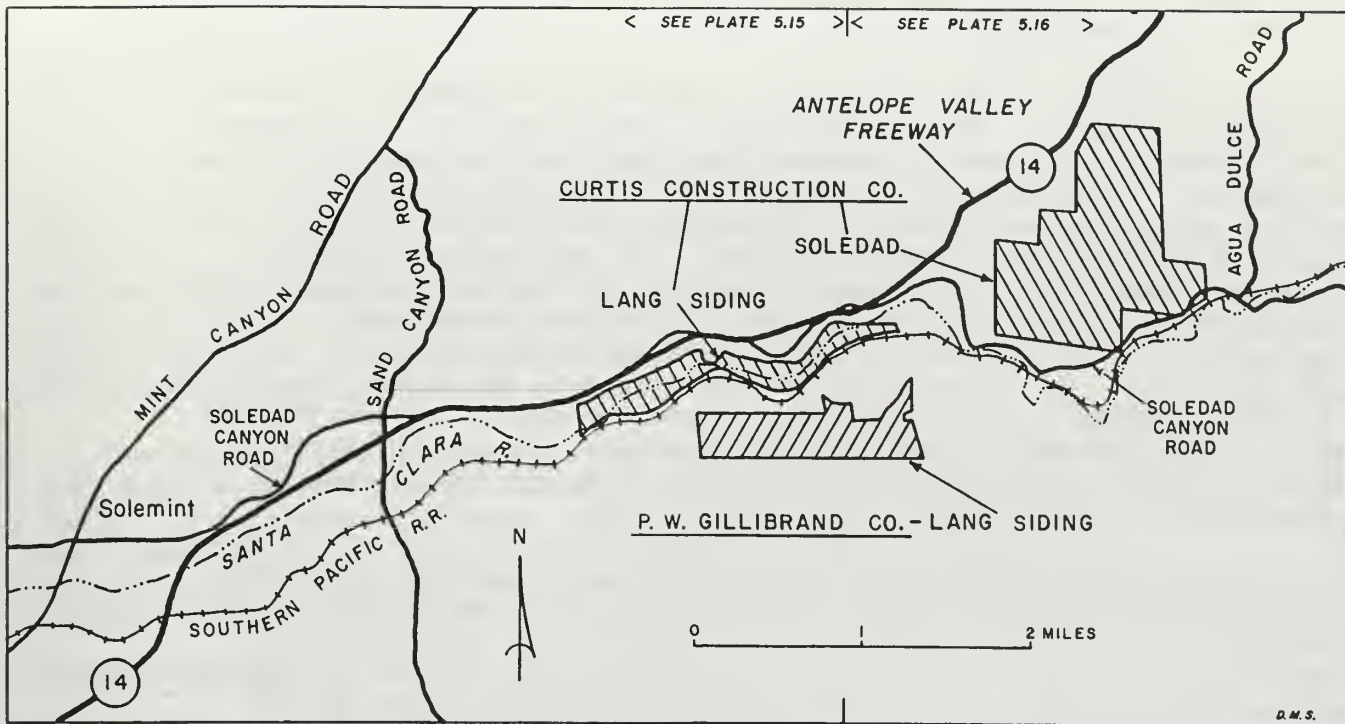


Figure 5.3. Saugus-Newhall production district: Sketch map showing land owned or leased by aggregate companies.

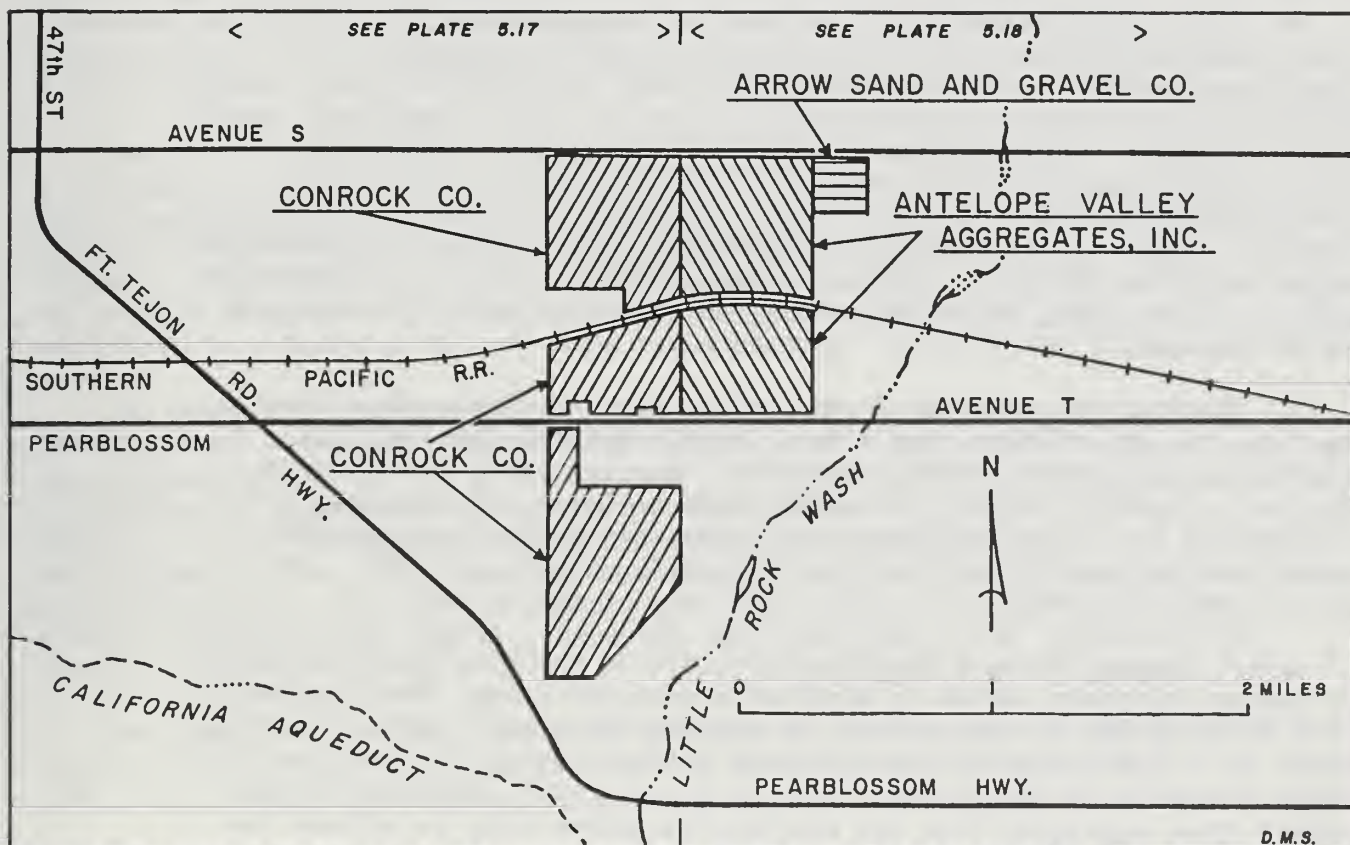


Figure 5.4. Palmdale P-C Region - Little Rock Creek Fan production district: Sketch map showing land owned or leased by aggregate companies.

in thickness. A total area of about 10 square miles of the river channel has been classified MRZ-2.

The coarse fraction of the deposit decreases downstream with distance from the river source. At Lang Siding this coarse fraction is estimated to be as much as 40 percent, containing boulders that measure up to 2 feet in diameter. The aggregate is composed of approximately 80 percent granitic rock, 5 percent reworked conglomerate and sandstone, and 16 percent metamorphic and volcanic rocks. The soft and potentially detrimental Pelona Schist fragments present in the western portions of the river has been introduced into the Santa Clara River deposits by tributaries west of Mint Canyon, which drain mountainous areas to the north and south. The percentage of Pelona Schist in the Santa Clara River west of Mint Canyon does not adversely affect the quality of the deposits enough to preclude the mining of P.C.C. aggregate. Presently, Curtis Company is producing from the Santa Clara River in the Saugus-Newhall region near Lang Siding.

Mint Canyon Formation. The Miocene Mint Canyon Formation is widely distributed in the Saugus-Newhall P-C Region covering approximately 45 square miles; 4 square miles are classified MRZ-2. The Mint Canyon Formation extends from 1 mile east of Agua Dulce Canyon to the San Gabriel fault on the west and is bounded on the north by Sierra Pelona and the south by the anorthosite-gabbro and granitic rocks of the San Gabriel Mountains (Oakeshott, 1958). (See Plates 5.1, 5.5, and 5.6 for MRZ-2 locations.)

The Mint Canyon Formation is composed of approximately 6,000 feet of fine- to coarse-grained well-consolidated non-marine sediments. The lower fluvial portion which is about 3,100 feet thick, consists of coarse-grained sediments derived chiefly from the local mountainous areas of Sierra Pelona and the western San Gabriel Mountains. This lower portion grades upward (south and west of Soledad Canyon) into finer grained sediments of lacustrine origin. The lower portion of Mint Canyon Formation, where it is currently being mined produces relatively durable coarse particles (pebbles, cobbles, and boulders) of granite, anorthosite, gabbro, and fragments of volcanic rocks which are suitable for Portland cement aggregate.

The parts of the Mint Canyon Formation which have been classified as MRZ-3 due to lack of data, may offer a high potential for yielding material suitable for concrete aggregate. Several parts of this unit, especially the fluvial section contain beds or lenses of sandstone or conglomerate that could possibly yield aggregate. The finer grained lacustrine sections of this unit are generally unacceptable for P.C.C.-grade aggregate.

Curtis Company mines a conglomeratic unit of the Mint Canyon Formation for coarse aggregate, which is mixed with sand and gravel from the Santa Clara River Valley at Lang Siding, to achieve the proper ratio of sand to gravel for P.C.C. P.W. Gillibrand mines a finer grained unit of the Mint Canyon Formation to the southwest for sand and gravel and mixes it with crushed stone aggregate from the anorthosite-gabbro body to achieve the correct ratio of sand to gravel for P.C.C.

Anorthosite-Gabbro Group. The San Gabriel Mountains south and southeast of Lang Siding contain 6 square miles of ground underlain by anorthosite and gabbro, classified MRZ-2 for its crushed stone aggregate resource.

The principal rock types of the basement anorthosite-gabbro group are andesine anorthosite, gabbroic anorthosite, anorthositic gabbro, and gabbro, which show sharp to gradational contacts and vary only in the proportion of feldspar to ferromagnesian (mafic) minerals. The anorthosite is composed of 0 to 18 percent mafic minerals, the gabbroic anorthosite is 10 to 22 1/2 percent mafic mineral, the anorthositic gabbro is 22 1/2 percent to 35 percent mafic minerals and the gabbro ranges from 35 percent to 65 percent mafic minerals.

The anorthosite and gabbro crop out along the southwestern portion of the Saugus-Newhall P-C Region forming rugged mountains of moderate to high relief. The anorthosite-gabbro is mined and crushed by the P.W. Gillibrand Company to form suitably resistant, though somewhat dense, coarse aggregate. Similar rocks also occur in the southwestern part of Palmdale P-C Region where they are currently not mined for aggregate use.

PALMDALE P-C REGION

Little Rock Creek Fan. This Holocene alluvial fan, which contains 12 square miles of area classified MRZ-2, extends northward from the north flank of the San Gabriel Mountains for a distance of about 8 miles. The fan area classified as MRZ-2 includes the Little Rock Wash floodplain and the fan area to the west. The maximum width of the fan is about 3 miles. The limit of the coarse fan material classified MRZ-2 was taken from mapping by Ponti and Burke (1980).

Due to grain size variations in the fan deposit, the thickness (depth) of minable material varies within the fan. In general, the portion of the fan along the Little Rock Wash and adjacent area west of the wash, contain thicker (deeper) economic material which has been mined to a depth of 85 feet. The remaining part of the fan, located more to the west, seems to consist of thinner (shallower) minable deposits which have been exploited to a depth of 55 feet (see cross-section, Plate 5.23).

The deposit classified MRZ-2 is generally composed of about 40 percent pebbly gravel with some cobbles and boulders, and 60 percent fine to coarse sand and silt. The gravel consists of fresh granitic rocks (granodiorite, quartz monzonite and quartz diorite) with small amount of gabbro, aplite, pegmatite, monzonite, quartzite, hornfels, and metavolcanic rocks. The sand is composed of quartz, mica, feldspar, and minor magnetite. The minable deposit contains a few clay interbeds. The coarse fraction of the deposit increases upstream towards the foothills of the San Gabriel Mountains.

Some parts of the fan, particularly areas located further to the west from the Little Rock Wash (and west of the Antelope Valley Aggregates' pits), may contain minable deposits in two distinct stratigraphic units.

The upper unit, classified MRZ-2, is light gray in color and about 15 to 85 feet thick, and the lower unit is 10 to 80 feet thick, light brown, more intensely weathered, and has a higher clay content and is classified MRZ-3 where exposed. The lower unit may produce suitable aggregate, if it is blended with the better material in the upper unit. The lower unit is not exposed in the pits in the Little Rock Creek floodplain.

The Little Rock Creek fan deposits have been mined for several decades by many operators, such as the John M. Ferry Rock Products (opened 1941) and Griffin Company (started in 1948, then Hare Company and since 1952 operated by Transit Mixed Concrete Company). Since 1952, many other companies have produced from this area, including Terminal Rock Company, Arrow Sand and Gravel Company, Triangle Rock Products, Rockway, Inc., and Blue Diamond Materials.

In 1961, the Antelope Valley Aggregates, Inc. bought its presently active mining area from John Ferry; the pits, which are 85 feet deep, do not expose the lower zone as mentioned above. The Quality Aggregates Company also produced small amounts from 1971 to 1976 in an area southeast of the Antelope Valley Aggregates, Inc. mining pits. In late September 1982, some production has been resumed from an old pit, north (northeast) of the Antelope Valley Aggregates operation, by the Arrow Sand and Gravel Company; this company previously produced aggregates in the area prior to 1961.

The portion of the fan deposit located west of the Antelope Valley Aggregates, Inc. plant was mined by Terminal Rock and Sand Company from 1955 to 1970. Until 1972 it was operated by Consolidated Rock Company, and since then it has been operated by Conrock Company. The mining excavations in this portion of the Little Rock Creek fan show the two units described above. At present, only Antelope Valley Aggregates, Inc., Conrock Company, and Arrow Sand and Gravel Company are operating.

Big Rock Creek Fan. The Big Rock Creek fan deposit is lithologically and mineralogically similar to the Little Rock fan. The Big Rock Creek fan extends northward from the San Gabriel Mountains for about 8 miles; however, it is larger than the Little Rock Creek fan. The Big Rock Creek fan contains about 26 square miles of MRZ-2.

The deposit has been mined to a maximum depth of 65 feet by Triangle Rock Products until 1974 and by California Portland Cement Company (1974-1977). No aggregate is now being mined in the Big Rock Creek fan area.

Areas Classified MRZ-3

Approximately 110 square miles of the Saugus-Newhall P-C Region and 994 square miles of the Palmdale P-C Region have been classified MRZ-3 (Plate 5.1). Areas so classified are those containing mineral deposits, the significance of which cannot be evaluated from available data. (Anderson, and others, 1979, Appendix A-3, p. 43). MRZ-3 areas located in valley and flatland regions within both P-C regions are generally underlain by Quaternary alluvial deposits containing sand and gravel of unknown quality.

MRZ-3 areas located in hilly or mountainous areas within the Saugus-Newhall P-C Region are generally underlain by Tertiary sedimentary and volcanic deposits. Portions of the anorthosite-gabbro group and Mint Canyon Formation that have been designated as MRZ-3 (due to a lack of data) may offer a high potential for yielding material suitable for P.C.C. aggregate. Parts of these two bedrock units are currently being mined for aggregate within the Saugus-Newhall P-C Region.

The Saugus, Vasquez, Tick Canyon, Towsley, and Pico formations are known to contain beds or lenses of sandstone or conglomerate that have a fair potential to yield aggregate. The Towsley and Pico formations have lower potentials as sources of concrete aggregate than the Vasquez, Tick Canyon, and Saugus formations.

All Tertiary sedimentary and volcanic rocks in the Palmdale P-C Region are zoned as MRZ-3 except for small areas underlain by fine-grained sedimentary units (which are classified as MRZ-1). The pre-Tertiary igneous and metamorphic rocks are also zoned as MRZ-3. These Tertiary rocks occur in the San Gabriel Mountains and other hilly terrain in the Mojave Desert.

Areas Classified MRZ-4

Areas classified MRZ-4 are those areas for which available information is inadequate for assignment to any other MRZ category. Within the Saugus-Newhall P-C Region, the only area so classified is in the Santa Clara River floodplain (Plates 5.1 and 5.3), a 0.1 square-mile area at the western edge of the region. Well-log data for this area is lacking. The Palmdale P-C Region does not contain any MRZ-4 area.

EVALUATION OF AGGREGATE RESOURCES IN THE SAUGUS-NEWHALL AND PALMDALE P-C REGIONS

An analysis of construction aggregate supply in the Saugus-Newhall and Palmdale P-C regions is presented in this section of the report. The analysis was conducted on the basis of a quantitative evaluation of aggregate resources contained in urbanizing portions of the both P-C regions. Similar evaluations have already been completed for the adjacent San Fernando Valley, Simi, and Western Ventura County P-C regions (SR 143 Parts I and II and SR 145 Parts I, II, and III).

Approximately 31 square miles of land in the Saugus-Newhall P-C Region and over 37 square miles of land in the Palmdale P-C Region has been classified MRZ-2 (Plates 5.1 and 5.2-5.12). In the Saugus-Newhall P-C Region this represents about 5 percent of the total area classified and in the Palmdale P-C Region, about 3 percent of the total area classified. A large portion of the sand and gravel deposits suitable for use as P.C.C. aggregate contained within these classified areas occur within the Santa Clara River channel and Little Rock Creek and Big Rock Creek fan deposits. These areas (MRZ-2) are largely nonurbanized and mostly non-permitted for aggregate extraction at this time.

In the Saugus-Newhall P-C Region the nonurbanized portion of the area classified MRZ-2 is divided into three parts based on the type of material present that collectively contain approximately 8,500 million tons of economically available aggregate resources. It is estimated that 100 percent of the reserves and resources are suitable for use as Portland cement concrete aggregate. However, particle-size distributions in the various deposits would require blending parts of one deposit with parts of another to achieve the proper mix for P.C.C. aggregate.

The MRZ-2 areas in the Palmdale P-C Region are divided into two sectors, the Little Rock and Big Rock fan deposits. Both sectors are geologically similar, and combined have over 2,200 million ton of minable aggregate resources.

For this project, terminology used to reflect the confidence level of the data base for this project has been adopted from U.S. Geological Survey Bulletin 1450-A (Appendix C, Part I). For our purposes, the two most important terms are reserves and resources. Reserves are materials believed to be acceptable for commercial use that exist within property owned or leased by an aggregate producing company for which permission allowing extraction and processing has been granted by the proper authorities. Reserve amounts are kept on file and not included in the present report. Resources include reserves as well as all potentially usable aggregate material that may be mined in the future, but for which no use-permit allowing extraction has been granted, or for which development has not been definitely established to be feasible based upon current technology or economic conditions.

Much of the resource evaluation of the Santa Clara River channel, Little Rock and Big Rock fans is based on drill-hole records. These drill holes were made over a time span extending back to the early part of this

century. They describe the types of earth material (silt, sand, gravel, and bedrock types) encountered at various depths. The quality of drill-hole descriptions range from poor to very good. Only drill-hole records that contain descriptions judged to be of high quality were used in the present study.

Mining Constraints

The quantity of reserves is highly dependent on both regulatory and economic constraints. For non-permitted resources, future regulatory and economic constraints may differ from those of the present. This may drastically reduce or enlarge the quantity of material available.

Regulatory Constraints

The majority of regulatory constraints of sand and gravel mining that limit the available resources in Los Angeles County are site specific. The restrictions are written in each conditional use permit issued to quarry operators by the Los Angeles County Planning Department. In drafting a permit, the Planning Department must take into account many federal, state, city, and local (such as flood control, water resources, and water districts) agency regulations and consider any recommendations that those agencies make concerning their areas of authority.

Most constraints fall under the following general categories: restraints of final grading configurations; limits on water course alterations; biota habitat preservation measures; limitations to prevent damage to adjoining property; incompatible land-use planning designations; and reclamation requirements.

Economic and Quality Constraints

In determining which areas should be classified MRZ-2 (significant deposits present) and in calculating reserves and resources within areas so classified, the following parameters were used:

1. Material meets the marketability and threshold value criteria given in the Guidelines for Classification of Mineral Lands (Anderson, and others, 1979, Appendix A-3, p. 43).
2. The deposit consists of sound, durable material substantially free of chemically reactive substances that would preclude its use as a Portland cement concrete (P.C.C.) aggregate.
3. Setbacks will be 100 feet from all developed areas when calculating resources outside of present aggregate producer property (use-permit required setbacks may differ on producer property).

In alluvial areas:

4. Combined clay and silt fraction does not exceed 25 percent by volume as determined from drill-hole data.
5. Technology limits extraction to a maximum of 100 feet below the water table.

In bedrock areas:

6. Technology limits extraction to the level of the adjacent drainages.

Resource Sectors

The Concept of Sectors

To organize the volume calculations of the aggregate resources, and to inform the Board about the resources within specific land-use areas, the State Geologist has utilized the concept of "sectors" to identify those MRZ-2 areas that meet the Board's guidelines as eligible to be designated of regional or statewide significance. Each sector shown on Plates 5.13 through 5.21 is a part of the nonurbanized MRZ-2 land where the geometrical configuration of the deposit is fairly uniform, so that tonnages of the mineral resource present can be estimated with some reliability. Some sectors that have been subdivided by highways and other intervening developments have been given sets of sub-sector numbers for ease of identifying individual areas. Where sector boundaries are adjacent to urbanized land, the volume of a 100 foot setback was subtracted from a total volume. The sector concept is used for the convenience of arraying resources information, and is not intended to imply any recommendation for designation or for designation priority. The sector criteria are given in the Appendix.

Much of the resource calculation that follows is based on an evaluation of more than eight hundred drill-hole records of variable reliability collected over a span of time extending back to the early part of this century. The drill-hole records describe the types of earth material (silt, sand, gravel, and bedrock types) encountered at various depths. The quality of drill-hole descriptions range from poor to very good, but only drill-hole records that contain descriptions judged to be acceptable for analysis were used in the present study.

All the aggregate resources in the Saugus-Newhall P-C Region identified as MRZ-2 occur within the Santa Clara River floodplain deposits, the Mint Canyon Formation, and the Anorthosite-Gabbro Group. In the Palmdale P-C Region, MRZ-2 areas are located within the Little Rock Creek and Big Rock Creek fan deposits. In the Saugus-Newhall Region, each of these areas is currently being mined and is placed in a different sector (A, B, and C) due to differences in the type of material in the deposits. The two MRZ-2 areas in the Palmdale Region contain similar type of material, but are placed in two separate sectors (D and E). Each of these five sectors includes areas that are currently permitted for aggregate extraction, are geologically similar, and which contain additional

aggregate resources. Sector A consists of the nonurbanized portion of the Santa Clara River floodplain including the major tributaries Newhall Creek, Castaic Creek, Bouquet Canyon, and Sand Canyon. Sector B contains areas of the Mint Canyon Formation currently being mined and areas of similar quality. Sector C includes the anorthosite-gabbro group which is currently being mined in part of the area. Sectors D and E contain the Little Rock Creek and Big Rock Creek fan deposits; both fans have been mined, but only the Little Rock Creek fan has active mining operations.

Saugus-Newhall P-C Region

Sector A - Santa Clara River. Sector A outlines the nonurbanized area (about 10 square miles) of the Santa Clara River floodplain, within the Saugus-Newhall P-C Region, which is underlain by deposits suitable for use as P.C.C. aggregate. This includes the area of Lang Siding where aggregate is presently being produced by Curtis Company (see Figure 5.3).

Drill-hole records of several water wells located in sector A indicate that sand and gravel extends from the surface downward to a depth of 54 to 80 feet. One hundred percent of the aggregate is believed to be suitable for use in Portland cement concrete. Most deposits underlying Sector A have demonstrated a sand to gravel ratio of about 3:2, mainly because of distance from the rock sources and reworking of the aggregate. The deposit in Oak Spring Canyon is an exception. Because of the shorter distance from the source area, there is a larger percentage of coarse material in this deposit.

The quantities of aggregate reserves and resources were calculated for the Santa Clara River area based on the following assumptions.

1. The material is assumed to have a 5 percent waste factor based on the operation of the Curtis Company, Lang Siding Plant.
2. In place density of the resource is assumed to be .065 tons per cubic foot (15.4 ft³ per ton) (From Special Report 139, Evans and others, 1977).
3. Pit-wall slopes will be calculated at a 1:1 gradient for non-permitted resources and will conform to use-permit requirements in the calculation of reserves.

On this basis, it is estimated that a total of 900 million tons of aggregate underlies Sector A. All of this aggregate is suitable for use in Portland cement concrete; however, predominance of sand would require additional coarse material for 100 percent usage as P.C.C.

The one company which presently mines within Sector A, mixes coarse aggregate extracted from the Mint Canyon Formation in Sector B with sand and gravel extracted from Sector A to achieve the proper ratio of sand to gravel for Portland cement concrete.

RESOURCES (MILLION SHORT TONS)

PERMITTED (RESERVES) resources (INDICATED CATEGORY)					
Saugus-Newhall P-C Region			Palmdale P-C Region		
SECTOR A	*	Sand & Gravel	SECTOR D	*	Sand & Gravel
SECTOR B	*	Sand & Gravel	SECTOR E	0	Sand & Gravel
SECTOR C	*	Crushed Stone			
TOTAL FOR BOTH P-C REGIONS 510					
NON-PERMITTED RESOURCES (INDICATED AND INFERRED CATEGORY)					
Saugus-Newhall P-C Region			Palmdale P-C Region		
SECTOR A	900	Sand & Gravel	SECTOR D	1,000	Sand & Gravel
SECTOR B	1,600	Sand & Gravel	SECTOR E	1,200	Sand & Gravel
SECTOR C	6,000	Crushed Stone			
Saugus-Newhall Total 8,500			Palmdale Total 2,200		

TABLE 5.1. Aggregate resources of the Saugus-Newhall and Palmdale P-C regions (all numbers in million short tons)

* Cannot be shown due to confidentiality of producer data

NOTE: All figures rounded to nearest 10 million.

The average waste factor for this sector may increase a few percent in the areas west or downstream of Mint Canyon. This is due to the introduction of fragments of soft Pelona schist from surrounding bedrock areas west of Mint Canyon.

Replenishment of sand and gravel occurs in the upper part of the channel during flood stages of the river. Although historically, replenishment of the Lang Sliding area has taken place about every 5 to 10 years, there is no guarantee of replenishment occurring at the time or in the quantities necessary to consider this a dependable resource to meet demand.

Sector B - Mint Canyon Formation. Sector B includes a large portion of the Mint Canyon Formation, covering about 4 square miles. Aggregate is currently being produced by the Curtis Company and P.W. Gillibrand Company in this sector (see Figure 5.2).

Before the amounts of aggregate reserves and resources within Sector B could be calculated, it was first necessary (1) to deduce the configurations of aggregate-bearing geologic units from knowledge of the geologic processes responsible for their formation, (2) to evaluate the history of mining operations in the Mint Canyon Formation, and (3) to learn both the effects of folding and faulting and the effects of technological constraints (slope requirements, drainage, etc.) on mining.

The Mint Canyon Formation has an exposed thickness of about 6,000 feet along Soledad Canyon. The Mint Canyon Formation, which unconformably overlies the Vasquez Formation and is in gradational contact with the Tick Canyon Formation, appears to fill canyons in a pre-existing topography of moderate relief. Paleocurrent measurements in the fluvial part of the Mint Canyon Formation indicate that the current flow was essentially from east to west down through Soledad Pass. Clasts in the northern and southern margins of the formation consist predominately of locally derived basement rock types, while clasts in the central part are dominantly of volcanic origin with most being foreign to the area and derived from east of the San Andreas fault. South of the volcanic conglomerate, granodiorite, anorthosite, and gabbro clasts predominate indicating that the source terrane was to the south in the San Gabriel Mountains. It is this part of the Mint Canyon Formation that has been classified MRZ-2. Clasts along the northern margin consist of locally derived syenite and blue-quartz granite scattered among volcanic clasts. West of Mint Canyon, clasts of Pelona schist are abundant near the base of the formation and between Bouquet and San Francisquito canyons the Mint Canyon Formation rests directly upon Pelona schist.

Curtis Company mines a conglomeratic unit of the Mint Canyon Formation for coarse aggregate which is mixed with sand and gravel from the Santa Clara River Valley at Lang Sliding, to achieve the proper ratio of sand to gravel for P.C.C. P.W. Gillibrand mines a finer grained unit of the Mint

Canyon Formation to the southwest for sand and gravel and mixes it with crushed aggregate from the anorthosite-gabbro body of Sector C to achieve the correct ratio of sand to gravel for P.C.C. Both companies also produce a full range of lesser quality products such as base, subbase, and fill from Sector B material.

Reserve and resource calculations for Sector B are based on the following assumptions:

1. Undesirable silt and clay size particles make up from 15 to 20 percent of the deposits based on the operations of the two plants in this area.
2. The in-place density of the resource is assumed to be .063 tons per cubic foot (15.9 ft³per ton) (from Special Report 139, Evans and others, 1977).
3. Final cut slopes are calculated at a 1:1 gradient from non-permitted resources and conform to use-permit requirements in the calculation of reserves.

Based upon these factors there are an estimated 1,600 million tons (Table 5.1) of inferred resources within Sector B. The reserve figure for the sector is confidential. It is estimated that all of these resources are of suitable quality for use as P.C.C. aggregate. Of the total of almost 1,600 million tons, it is calculated that 1,040 million tons is coarse material and 530 million tons is fine.

Sector C - Anorthosite - Gabbro Group. Sector C includes a portion of the anorthosite-gabbro group (about 6 square miles) that is likely to be of sufficient quality to be acceptable for use as P.C.C. aggregate. Crushed aggregate is currently being produced by P.W. Gillibrand Company in this area.

The Precambrian anorthosite-gabbro group forms a large massif in the western San Gabriel Mountains and eastern Soledad Basin. The most abundant rock type is purplish-gray to blue-gray and white andesine anorthosite. It occurs in association with gabbro (norite), as a stratiform body with compositional layering that has been subsequently folded, faulted, and intruded by granitic rocks.

The anorthosite was mined in 1954 for the manufacture of Portland pozzolan cement. Presently P.W. Gillibrand mines principally the norite for use as crushed aggregate. The crushed aggregate is mixed with sand and gravel from the Mint Canyon Formation to make the correct ratio of sand to gravel for P.C.C. The only drawback is the high density of the norite which creates a lower volume to weight ratio than that for normal aggregate.

Resource calculations for Sector C are based on the following assumptions:

1. The waste factor is assumed to be 5 percent based on the operation of the P.W. Gillibrand plant.
2. The in place density of the material is assumed to be .080 tons per cubic foot (2.5 ft³per[ton) (from Special Report 139, Evans and others, 1977).
3. Final slopes for resource calculations are set at 1:1.

Based on these assumptions, it is calculated that there are 6,000 million tons of crushed stone aggregate resource in Sector C. The reserve calculation is confidential and is included in the reserve total for both P-C regions.

Palmdale P-C Region

Sector D - Little Rock Creek Fan. Sector D includes the main portion of the Little Rock Creek alluvial fan, which covers almost 12 square miles. Quaternary (Holocene) alluvial deposits that are suitable for use as P.C.C. aggregate are currently being mined by the Conrock and Antelope Valley Aggregate companies in this sector (see Figure 5.4).

Interpretation of the drill-hole records and mining data from companies currently operating in Sector D indicate minable sand and gravel extending from the surface downward to a depth of 30 to 80 feet. This variation in thickness is due to proximity to the apex of the alluvial fan and to the main course of Little Rock Creek. (see cross section B-B' Plate 5.23). About 20 percent of these conglomeritic deposits are composed of fine material not suitable for concrete aggregate, and therefore is subtracted as a waste factor in the calculation of the total amount of sand and gravel which can be used as various aggregate products. Of the usable 80 percent that is mined, the ratio of sand to gravel extracted is approximately 1:1. The in-place density factor for this material is assumed to be .060 -.065 short tons per cubic foot (15.4 - 16.7 ft³per ton) (from Special Report 139, Evans and others, 1977). The pit-wall slopes were calculated at a 1:1 gradient for non-permitted resources and conformed to use-permit requirements in the calculation of reserves. Based upon the previously mentioned factors, the total inferred resource for this sector is estimated at 1,000 million tons. The reserve figure for Sector D is confidential and is included in the total for both P-C regions.

Sector E - Big Rock Creek Fan. Sector E includes the main portion of the Big Rock Creek alluvial fan, which covers about 26 square miles. These Holocene alluvial deposits were mined by Triangle Rock from 1967 to 1973 for P.C.C. aggregate use. Aggregate is not currently being mined in this sector.

Well-log data was not available for the area; therefore geologic map interpretation, field investigation, and verbal communication with the aggregate companies that were previously in operation provided the only information for determining the depth and extent of minable sand and gravel in Sector E. Visual inspection at the abandoned Triangle Rock Products, Inc. location, and verbal communication with the previous mining operators indicates that minable sand and gravel extends from the surface downward to a maximum depth of 50 to 55 feet.

The methods of calculation of aggregate resources within the sector was based on the depth previously mined above and the typical geometry and stratigraphic relationships within alluvial fans. Because of the presumed similarity of the Big Rock Creek fan material with the Little Rock Creek fan material, an identical waste factor of 20 percent was subtracted from the total calculated amount of sand and gravel available as a resource in this sector and an identical density factor of .060 - .065 short tons per cubic foot (15.4 - 16.7 ft³per ton) was assumed. The pit-wall slopes were calculated at a gradient of 1:1.

On this basis the total inferred resource for this sector is estimated at 1,200 million tons (Table 5.1).

ESTIMATED 50-YEAR CONSUMPTION OF AGGREGATE

The total projected combined consumption of aggregate in the Saugus-Newhall and Palmdale P-C regions for the next 50 years is estimated to be 173 million tons (Tables 5.2 and 5.3). Of this, the projected consumption for the Saugus-Newhall P-C Region is 51 million tons and 122 million tons for the Palmdale P-C Region. These estimates are based on projected population data and an average per capita use figure, as described in Part I of Special Report 143 under "50-Year Forecasts." (Anderson, and others, 1979).

Aggregate Production Records

Aggregate production records were compiled for the year 1960 through 1980 for both the Saugus-Newhall and Palmdale P-C regions (Figures 5.5 and 5.6). Records for these areas for the years prior to 1960 are, in most cases, incomplete. Aggregate production data was obtained from the United States Bureau of Mines (USBM) statistics. These records are compiled from responses to a questionnaire that is sent out on an annual basis to all known mining operations. Each producer is requested to divulge the amount and value of its annual production for the preceeding year. It is important to note that the degree of accuracy of these statistics depends strictly on the correctness of the producer's response. The DMG staff did not seek to verify production data, or to get production data from companies who did not respond to the USBM inquiries.

Population Records

Population data for the Saugus-Newhall and Palmdale P-C regions were also compiled for the years 1960-1980 (Figures 5.5 and 5.6). Population data for the three adjacent P-C regions were taken from previous reports (Figures 5.7 - 5.9). The historical population data for the period 1960-1980 was obtained from statistical bulletins that have been published by Los Angeles and Ventura counties on a quarterly or annual basis.

Population projections for the years between 1980 and 2020 were extracted for the P-C regions from area projections furnished by the California State Department of Finance (1977), and the Southern California Association of Governments (1982). Population projections for the 12-year period between 2020 and 2032 were extrapolated by DMG staff by a straight-line continuation of the compiled 1980-2020 projections. The population projections are presented in Figure 5.10.

Per Capita Consumption Rates

Per capita consumption rates of aggregate have varied through time and are generally different for each P-C region (Figure 5.11). Several factors such as changes in urban growth, relative degrees of urban maturity, and proximity to major construction projects (for example, Freeways), as well as errors in recordation of aggregate production, account for some of the variations and differences.

The historical per capita consumption rates shown on Figure 5.11 were obtained from comparing the yearly aggregate production data for each P-C Region with the respective population data described in preceding paragraphs. An average consumption of 10.0 tons of aggregate per person per year was determined for the Saugus-Newhall P-C Region and 12.2 tons per person per year for the Palmdale P-C Region from the annual rates. In calculating the historical per capita consumption rate of the Saugus-Newhall P-C Region, a yearly export of aggregate of 30 percent was subtracted from the production figures. This export goes principally to the adjacent San Fernando Valley P-C Region.

Compared with the San Fernando Valley P-C Region, the historical per capita use of construction aggregate in the Saugus-Newhall and Palmdale P-C regions is much higher (Figure 5.11). High per capita consumption rates are characteristic of regions with low population densities (Figure 5.12), whereas low per capita consumption rates are characteristics of regions that are close to or have reached urban maturity (the point at which construction aggregate is used primarily to maintain existing development rather than to supply further development). The relatively low population densities of the Saugus-Newhall and Palmdale P-C regions suggests a high growth potential in the forthcoming years. Therefore, the per capita consumption rates are not expected to diminish within the next 50 years.

The annual per capita consumption rates for the Saugus-Newhall and Palmdale P-C regions show wide variations over the past 20-year period (Figure 5.11) in comparison with other greater Los Angeles area P-C regions. Analysis of the correlation between total population and annual aggregate production over this period shows a low correlation in both P-C regions.

An important factor in the high variability of aggregate production in the Saugus-Newhall P-C Region is its nearness to the much larger population center in the Los Angeles basin. Many construction projects, such as freeways and reservoirs, for the service of the San Fernando Valley, are located close to or partly within the Saugus-Newhall P-C Region and must use aggregate supplied by plants in that region. Also, there is a likelihood that there will be a future increase in exported aggregate from the Saugus-Newhall P-C Region to the San Fernando Valley. At present, about 30 percent of the aggregate production of the Saugus-Newhall P-C Region is exported to the San Fernando Valley. The effect of these demands is that the Saugus-Newhall P-C Region will have to be considered a part of the San Fernando Valley P-C Region in the future.

Although the population factor has been overshadowed in both the Saugus-Newhall and Palmdale P-C regions by less predictable factors such as major construction projects and exports to adjacent regions, the significance of total population of a region as a factor in aggregate consumption has been demonstrated in studies of other regions in the greater Los Angeles area (SR 143, Parts I-IV). Therefore, the historical per capita consumption rate was compared with the projected population estimates obtained from DOF and SCAG to determine a total projected consumption of aggregate from 1982 to 2031 for both P-C

regions (Tables 5.2 and 5.3). Events such as massive urban renewal or disaster reconstruction would result in sharp increases in consumption of aggregate. The amount of aggregate needed in addition to the projected consumption in either area would depend on the extent and duration of reconstruction. Aggregate consumption probably would then return to a level equivalent to that which is predicted.

YEARS	AVERAGE POPULATION (million)	5-YEAR PER-CAPITA CONSUMPTION (tons)	AGGREGATE CONSUMPTION (million tons)
1982-1986	.08	50	4
1987-1991	.09	50	5
1992-1996	.09	50	5
1997-2001	.10	50	5
2002-2006	.10	50	5
2007-2011	.10	50	5
2012-2016	.11	50	6
2017-2021	.12	50	6
2022-2026	.12	50	6
2027-2031	.13	50	7
			TOTAL 54

Table 5.2 Projected aggregate consumption (in million short tons) to the year 2032 for the Saugus-Newhall P-C Region.

YEARS	AVERAGE POPULATION (million)	5-YEAR PER-CAPITA CONSUMPTION (tons)	AGGREGATE CONSUMPTION (million tons)
1982-1986	.12	61	7
1987-1991	.14	61	9
1992-1996	.16	61	10
1997-2001	.19	61	12
2002-2006	.22	61	13
2007-2011	.22	61	13
2012-2016	.23	61	14
2017-2021	.23	61	14
2022-2026	.24	61	15
2027-2031	.24	61	15
			TOTAL 122

Table 5.3 Projected aggregate consumption (in million short tons) to the year 2032 for the Palmdale P-C Region.

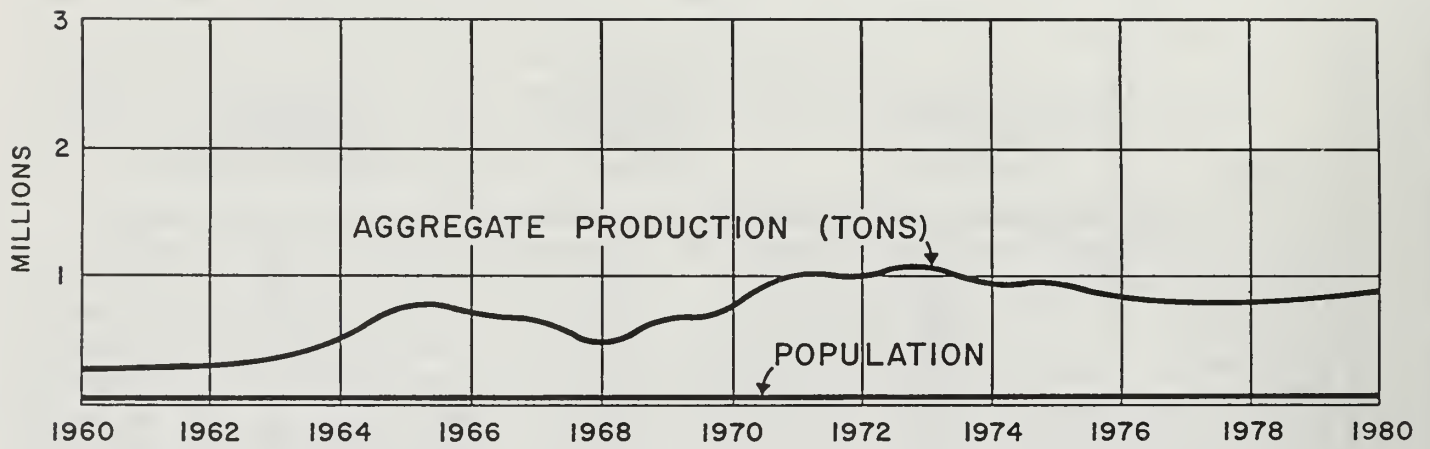


Figure 5.5 Saugus-Newhall P-C Region: Population and aggregate production records for years 1960-1980.

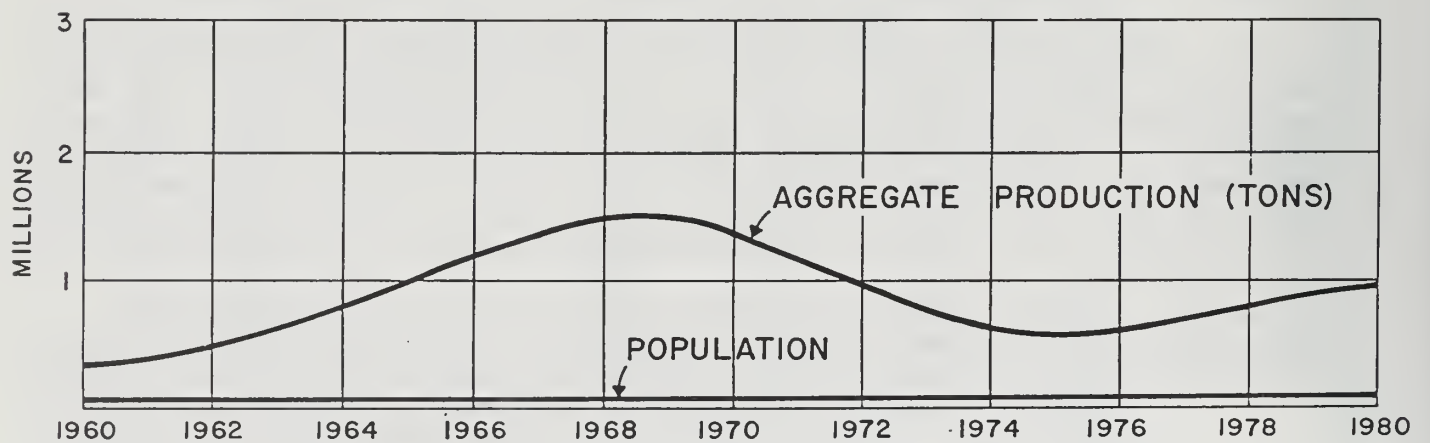


Figure 5.6 Palmdale P-C Region: Population and aggregate production records for years 1960-1980.

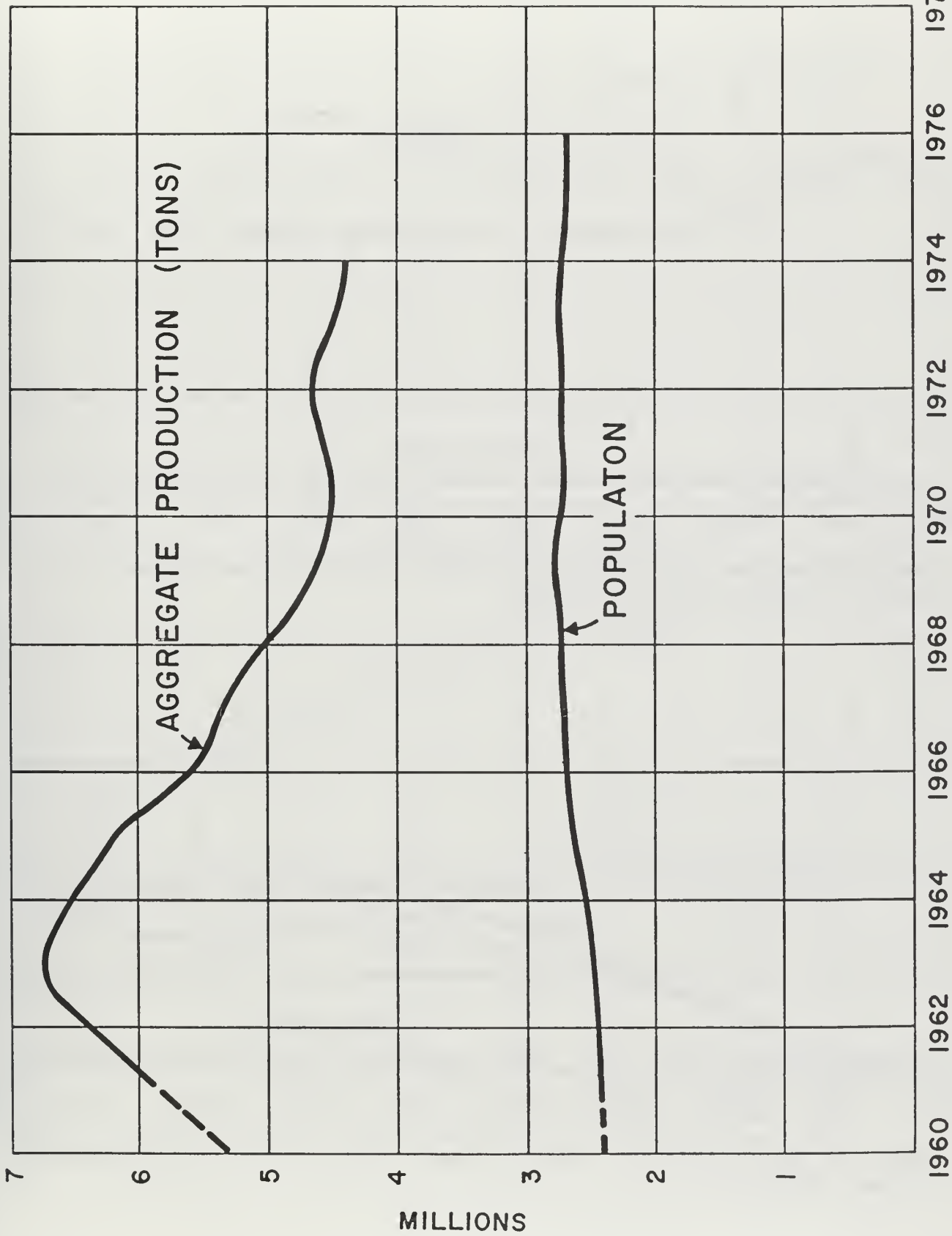


Figure 5.7 San Fernando Valley P-C Region: Population and aggregate production records for years 1960-1976.

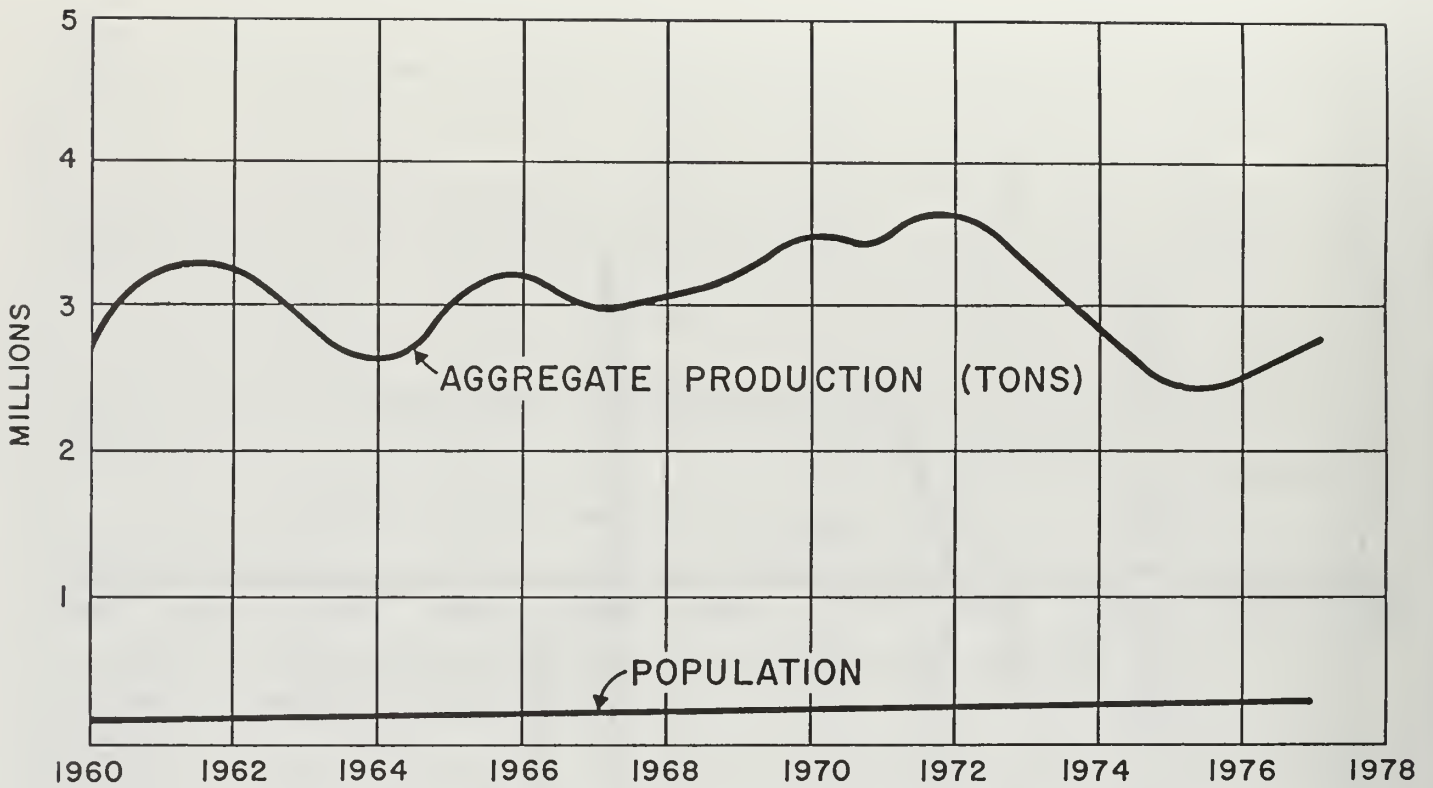


Figure 5.8 Western Ventura County P-C Region: Population and aggregate production records for years 1960-1977.

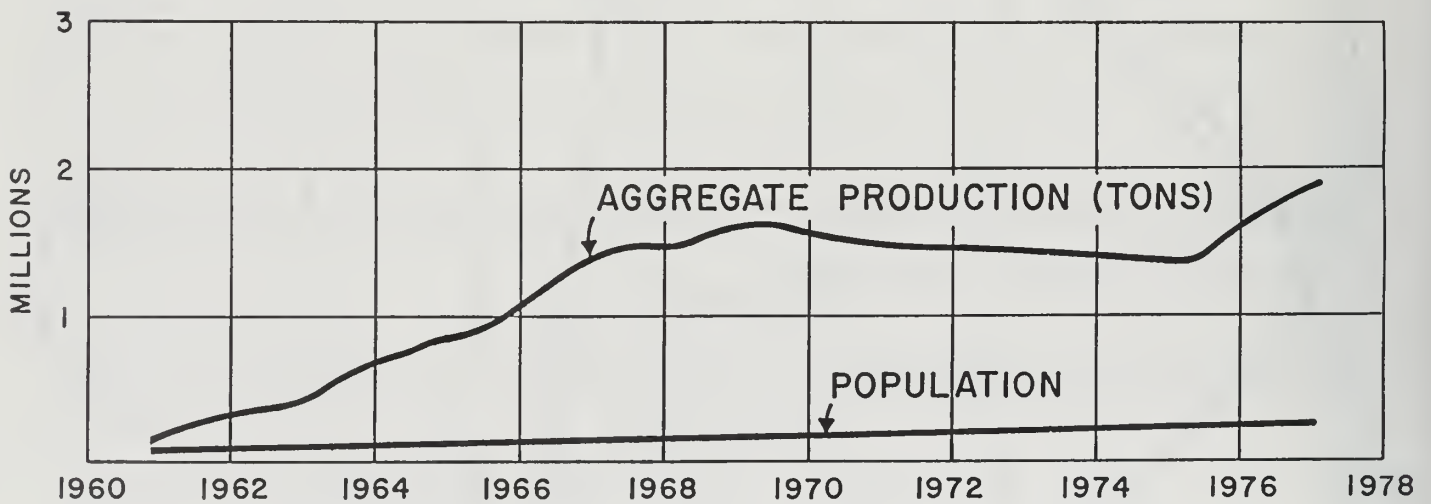


Figure 5.9 Simi P-C Region: Population and aggregate production records for years 1960-1977.

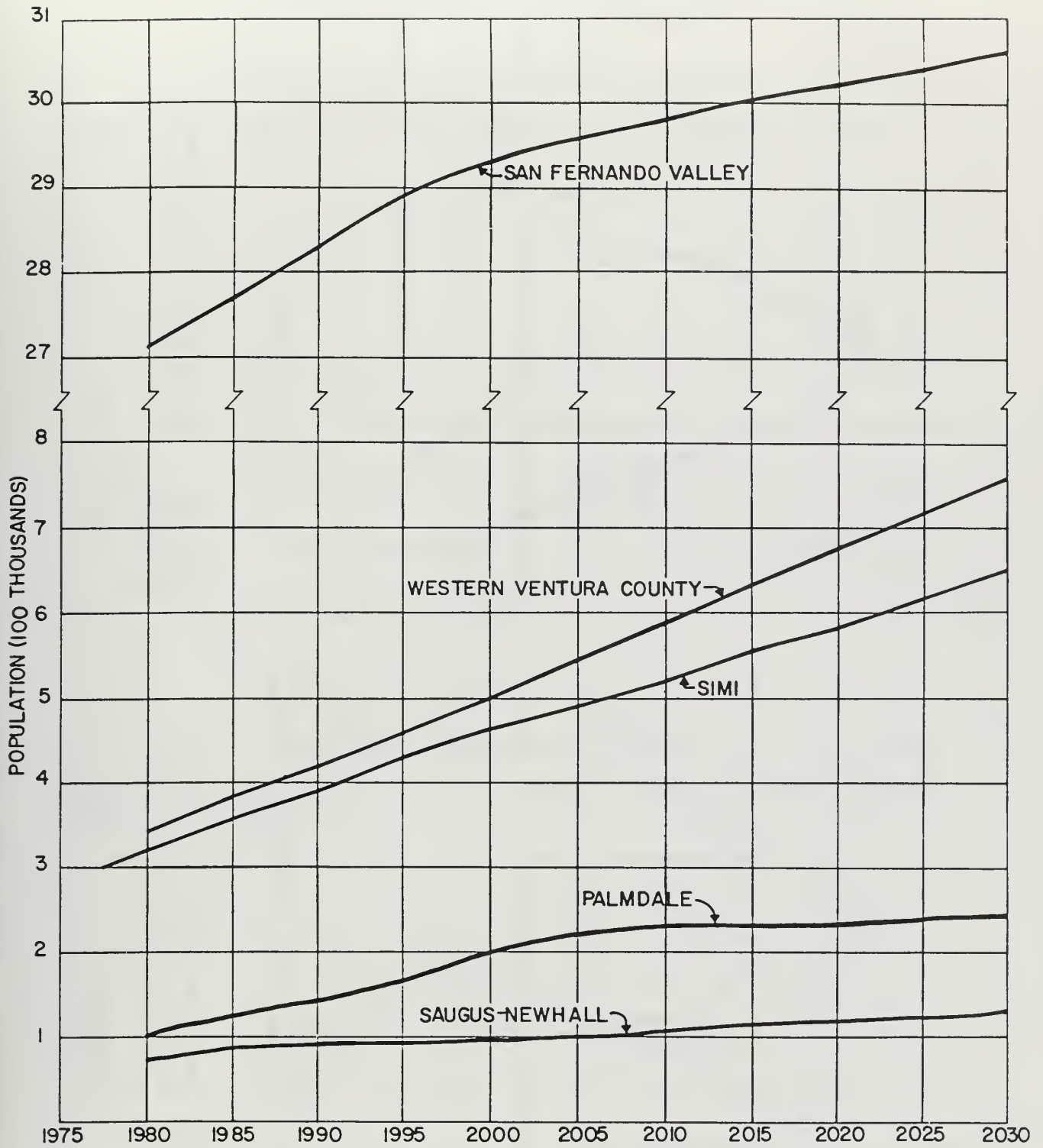


Figure 5.10 Projected populations (50 years from the date of study) of the Saugus-Newhall, Palmdale, San Fernando Valley, Western Ventura county and Simi P-C regions.

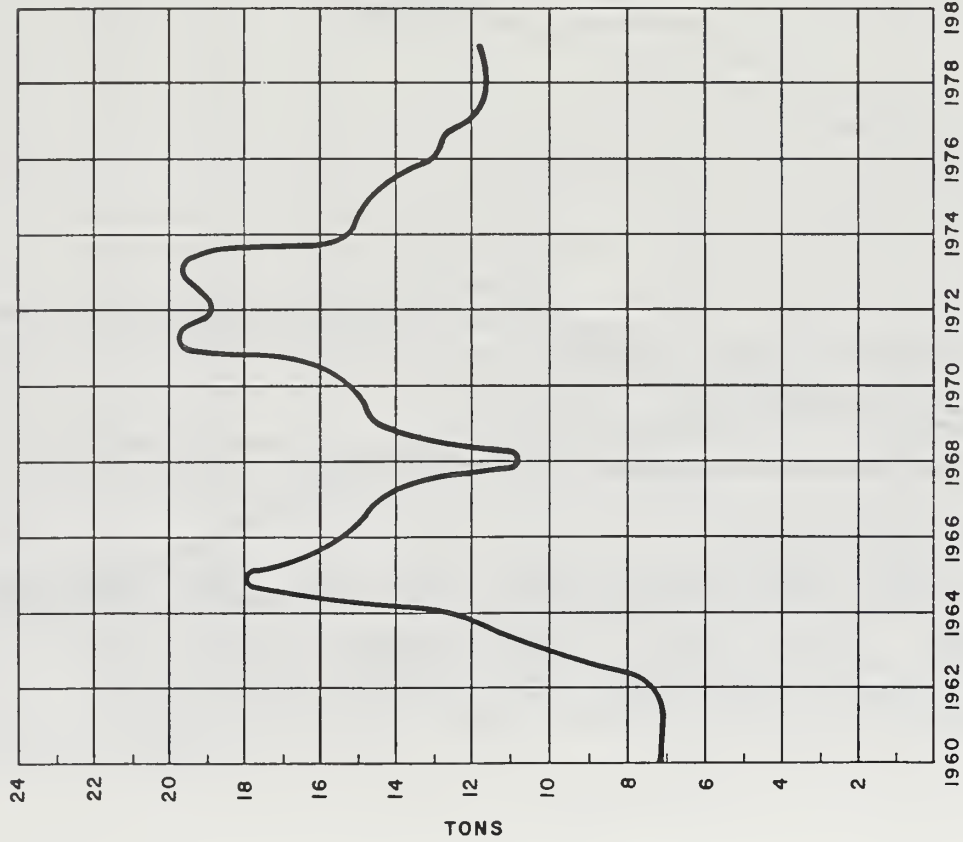


Figure 5.11a Annual per capita consumption of aggregate in the Saugus-Newhall P-C Region.

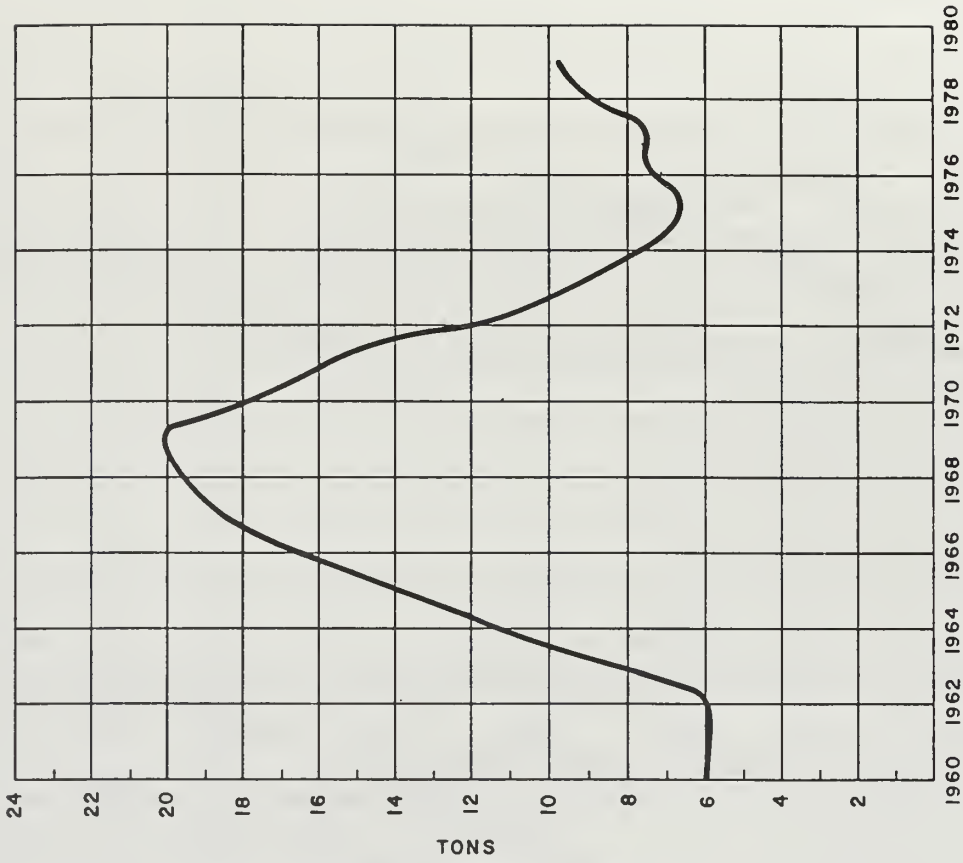


Figure 5.11b Annual per capita consumption of aggregate in the Palmdale P-C Region.

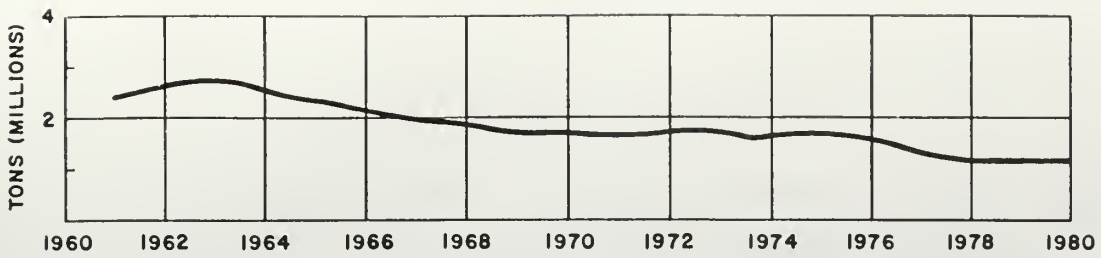


Figure 5.11c Annual per capita consumption of aggregate in the San Fernando P-C Region.

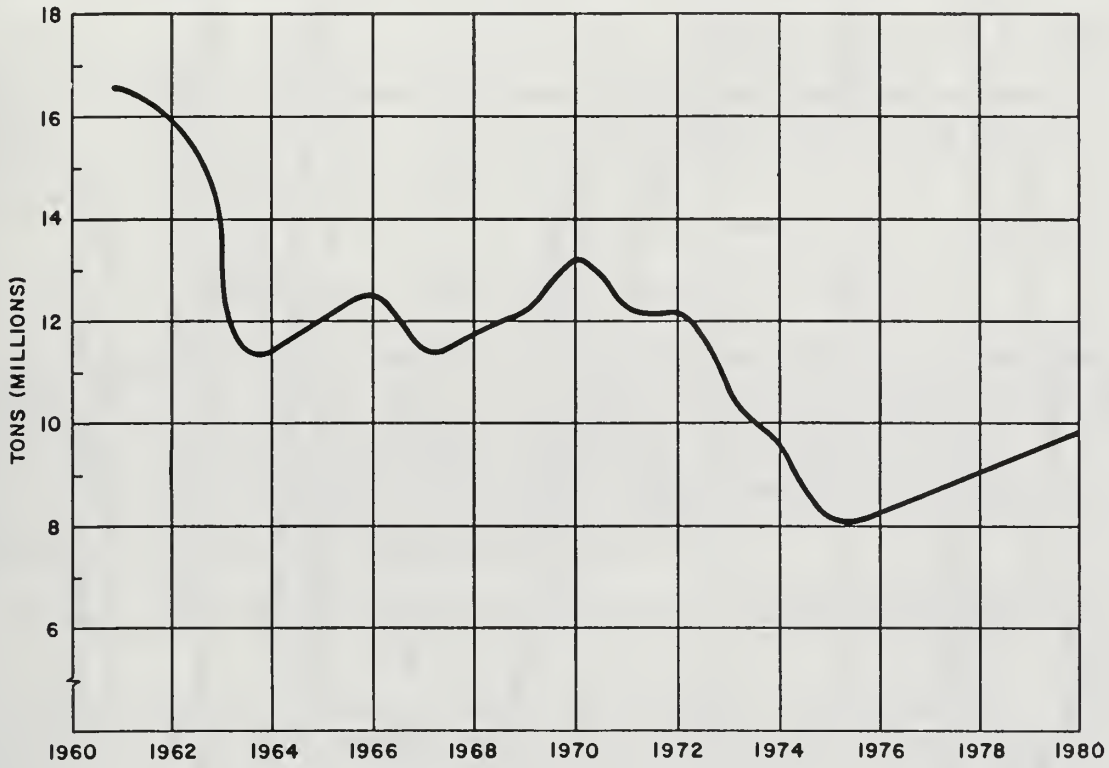


Figure 5.11d Annual per capita consumption of aggregate in the Western Ventura P-C Region.

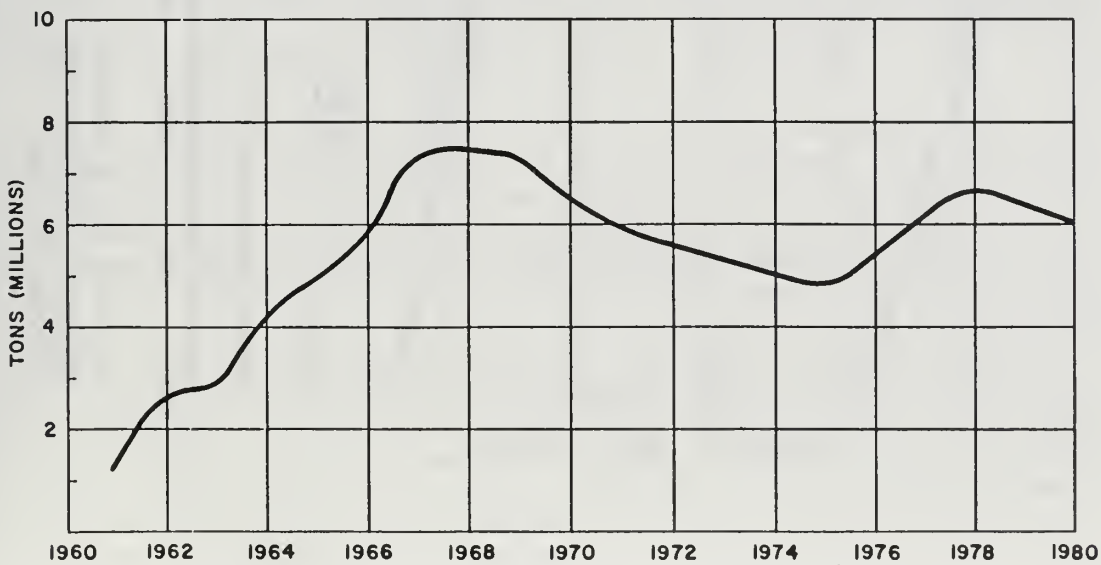


Figure 5.11e Annual per capita consumption of aggregate in the Simi P-C Region.

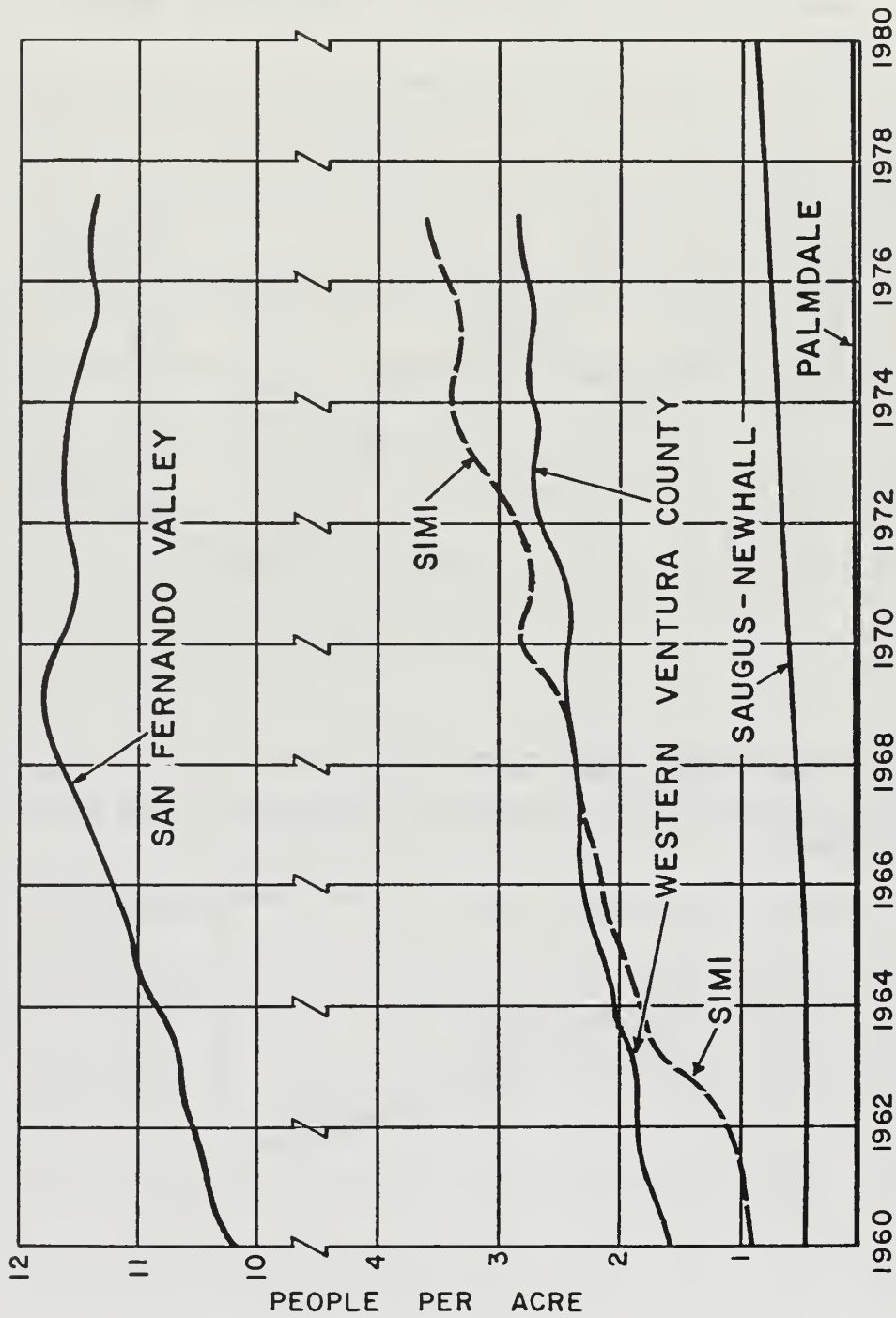


Figure 5.12 Comparison of population densities for Saugus-Newhall, Palmdale, San Fernando Valley, Western Ventura County, and Simi P-C regions for years 1960-1980.

ALTERNATIVE SOURCES OF AGGREGATE

Potential sources of aggregate, in addition to those described in Sectors A, B, C, D, and E, occur in areas within or near the Saugus-Newhall and Palmdale P-C regions (Plate 5.24). These include resources in adjacent P-C regions and areas underlain by Quaternary alluvial sediments, Tertiary sedimentary rocks and older igneous and metamorphic rocks.

Except for the resources in adjacent P-C regions, too little is known about the physical and chemical properties (see SR 143, Part I, "Overview of Aggregate") of alternative sources of aggregate to permit even crude resource estimates. However, a general discussion about the potential resources, their occurrence, and factors controlling their utilization is presented in the following section.

Sand and Gravel Resources of Adjacent P-C Regions

The reserve and non-permitted resource figures for the adjacent San Fernando Valley P-C Region are taken from California Division of Mines and Geology Special Report 143, Part II (Anderson and others, 1979). The reserve and non-permitted resource figures for the Simi and Western Ventura County P-C regions are taken from Special Report 145, Parts II and III (Anderson and others, 1981). The estimated resources of the adjacent P-C regions are presented on Table 5.5.

Estimated 50-Year Consumption of Aggregate in Adjacent P-C Regions

Estimated 50-year aggregate needs for adjacent P-C regions are presented on Table 5.4. Comparison of Tables 5.4 and 5.5 shows that the reserves alone in the San Fernando Valley and Western Ventura County P-C regions is not sufficient to supply their 50-year projected needs for aggregate. Consequently, these two regions will be forced to acquire aggregate from their non-permitted resources or from supplies outside those regions. The latter course is likely to have a major negative impact upon the Saugus-Newhall P-C Region's supply of aggregate.

Production from present sources in the three adjacent P-C regions - San Fernando Valley, Simi, and Western Ventura County - represents the most immediate alternative source of aggregate. The disadvantages of increasing dependency on these sources in the future are increases in haulage costs, added air pollution attendant to longer haulages, and lack of control of those sources by the market population of the Saugus-Newhall P-C Region. The last disadvantage may become important when present reserves in adjacent P-C regions are depleted, which is projected to happen in the San Fernando Valley and Western Ventura County P-C regions within the 50-year projection period. The possibility of future aggregate supply from these regions, and perhaps the Simi P-C Region as well, may depend on land-use decisions made without consideration of the aggregate needs of the Saugus-Newhall P-C Region.

San Fernando Valley (1980-2030):	234
Western Ventura County (1980-2030):	310
Simi (1980-2030):	130

Table 5.4 Projected aggregate consumption of P-C regions adjacent to the Saugus-Newhall P-C Region in millions of tons.

PRODUCTION- CONSUMPTION REGION	INFERRED RESERVES (Million Tons)	INFERRED RESOURCES (Million Tons)	TOTAL (Million Tons)
SAN FERNANDO VALLEY	40	720	760
WESTERN VENTURA COUNTY	42	4800*	4842
SIMI	173	1000*	1173
CATEGORY TOTAL	255	6520	6800*

TABLE 5.5 Aggregate resources of the San Fernando Valley, Western Ventura County, and Simi P-C regions.

* Figures rounded to nearest 100 million.

Tertiary Sedimentary Rocks as Alternative Sources of Aggregate

A vast portion of the Saugus-Newhall and Palmdale P-C regions are underlain by Tertiary sedimentary rocks. Some of these sedimentary units are possible alternative sources of aggregate material.

Saugus-Newhall P-C Region

Of the Tertiary sedimentary units within Saugus-Newhall P-C Region, only the Mint Canyon Formation is presently being mined for sand and gravel. It has sections that are classified as MRZ-2 in addition to the areas classified as MRZ-3. Some of the areas in the Mint Canyon Formation, especially the fluvial portions, have a high potential as a source of aggregate. A geologic description of this unit is in the section on Areas Classified MRZ-3.

The Saugus Formation (classified as MRZ-3 in this report) is a potential alternative aggregate source. Although in many areas the Saugus Formation contains an abundance of clayey silt, clayey sandstone, and sandy mudstone layers there are localities where it consists of relatively clean sandstone and conglomerate. The conglomerate clasts are generally composed of well-rounded granitic rocks, gneisses, gabbro, and anorthosite with locally abundant clasts of Pelona schist. Those areas with abundant schist fragments will probably not be suitable for P.C.C. aggregate. The conglomerate sections are loosely consolidated and could probably be excavated with heavy equipment. It is noteworthy that about 5 miles southwest, in the Simi P-C Region, the Saugus Formation is presently being mined for aggregate material.

The Vasquez Formation (classified as MRZ-3 in this report) is a potential alternative source of aggregate, especially near the base of the formation where it consists of about 800 feet of conglomerate with boulders up to a foot in diameter. The coarse clasts consist of granitic and dioritic rocks and gneisses. The Vasquez Formation is well indurated and contains interbedded volcanics and volcanic breccias which may require blasting to mine. A detailed evaluation would have to be made to determine its suitability as a source of Portland cement concrete aggregate.

The Tick Canyon Formation (classified as MRZ-3 in this report) is another possible alternative source of aggregate. It contains lenses of conglomerate consisting of granitic and volcanic rocks which may be suitable as Portland cement concrete. The volcanic clasts in both the Tick Canyon and Vasquez formations need a more detailed evaluation to be sure that they are not reactive with Portland cement.

The Towsley and Pico formations (classified as MRZ-3 in this report) are known to contain lenses of sandstone or conglomerate that could yield workable deposits, but are believed to be of low potential as sources of concrete aggregate.

PALMDALE P-C REGION

Although none of the Tertiary rock units within the Palmdale P-C Region is presently mined for aggregates, most of the Tertiary sediments (zoned as MRZ-3 areas) are possible alternative sources of aggregate material, except for small areas underlain by fine-grained rock units within the San Francisquito, Punchbowl, Anaverde, and Juniper Hill formations. Larger areas of these fine-grained units are classified as MRZ-1 (see Plate 5.1).

Within the Tertiary formations, the MRZ-3 areas (which are possible alternative aggregate sources) include the coarser grained and conglomeratic units of San Francisquito, Vasquez, Neenach Volcanics, Quail Lake, Oso Canyon, Punchbowl, Anaverde, Ritter, Hungry Valley, and Juniper Hills formations. All these formations are located in the San Gabriel Mountains, along and adjacent to the San Andreas fault zone.

Quaternary Alluvial Deposits as Alternative Sources of Aggregate

SAUGUS-NEWHALL P-C REGION

Most of the floodplain of the Santa Clara River drainage system is classified as MRZ-2; this includes two major tributaries - Castaic Creek and Newhall Creek. The remainder of the tributaries which contain substantial alluvial deposits are classified as MRZ-3 due to a lack of drill-hole data. The larger of these remaining tributary alluvial deposits which may be future sources of aggregate suitable for P.C.C. are in San Francisquito, Bouquet, Mint, Upper Soledad, Oak Spring, Sand, Pico, and Hasley Canyons. San Francisquito, Bouquet, and Mint canyons all drain areas underlain by Pelona schist in their uppermost reaches. Clasts derived from the Pelona schist are mostly undesirable in P.C.C. aggregate and are a degrading factor for these deposits; the extent of schistose material in these deposits is not known.

PALMDALE P-C REGION

Most of the Pleistocene and Holocene sediments in the Palmdale P-C Region can be considered as potential alternative source of aggregate, except for the finer grained units (clay and silt) of Pleistocene sediments (such as the Lacustrine deposits in the vicinities of the Rosamond Lake) and Holocene sediments east of Alpine and Lovejoy buttes. These areas underlain by fine grained sediments are zoned as MRZ-1 (see Plate 5.1)

All MRZ-3 areas in the Palmdale P-C Region are possible aggregate sources and include coarser grained and gravelly units of the Nadeau Gravel, Shoemaker Gravel, Sandberg, and Harold formations, and also many other Pleistocene and Holocene units (see Plate 5.1).

Crushed Stone as Alternative Sources of Aggregate

The anorthosite-gabbro group is currently being mined for crushed stone and it appears that most of this material, which is exposed over a large area within and adjacent to the southeastern part of the Saugus-Newhall P-C Region and southwestern part of Palmdale P-C Region is of acceptable quality for use as aggregate material. In the Saugus-Newhall P-C Region the predominantly gabbroic rocks are classified MRZ-2 and the anorthositic rocks are classified MRZ-3. Although the suitability of the predominantly anorthosite rocks has not been tested, it is likely that these rocks would be acceptable for use as crushed P.C.C. aggregate. Both types of rocks are classified as MRZ-3 in the Palmdale P-C Region.

Another possible source of crushed stone are the volcanic rocks that are part of the Vasquez Formation which is classified MRZ-3. The Vasquez Formation volcanics are composed of 3,800 feet of black and red-weathering, highly vesicular, basalt. It is possible that some of this material might be crushed and processed into aggregate material if the stone is of acceptable quality.

Additional possible sources of crushed stone are the plutonic and metamorphic rocks in both P-C regions. The plutonic rocks include granite, quartz monzonite, granodiorite, quartz diorite, diorite, syenite, and migmatite. Some of the metamorphic rocks are schist (such as Pelona schist, Portal schist), gneiss, marble, rhyolite, skarn, hornfels, and amphibolites. The granite is in places a gneissic, two-mica granite which appears to be relatively durable. The syenite is a medium to coarse massive rock composed largely of feldspar with a small percentage of ferromagnesian minerals. Some of the igneous and metamorphic rocks may have weathering alterations which could affect the durability of the material. Exploration and testing will be necessary to identify and delineate any resource suitable for crushed stone in this terrane.

In the Saugus-Newhall P-C Region, most of these alternative sources of crushed stone lie within the boundaries of the Angeles National Forest. Mining permits in this area are issued by the Forest Service and opportunities for future mining activity are uncertain. Only a small portion of the Palmdale P-C Region lies within the Angeles National Forest.

SUMMARY OF DESIGNATION FACTORS

All three of the resource sectors in the Saugus-Newhall P-C Region are important for continued aggregate production over the next 50 years. Although Sector B contains most of the reserves within the Saugus-Newhall P-C Region, both of the other sectors - A and C - contribute sizes of aggregate, that are necessary for making P.C.C., that reserve deposits in Sector B are deficient in. All three sectors contain large resources of P.C.C. - grade aggregate. Sector C is not entirely interchangeable with the alluvial aggregate of Sectors A and B.

In the Palmdale P-C Region Sector D is the most important because it contains all of the regions reserves of P.C.C. grade aggregate. However, Sector E has slightly more aggregate resources available (1,000 million tons in Sector D vs. 1,200 million tons in Sector E) and should be considered important for future supply in the region.

CONCLUSIONS

Current reserves within the Saugus-Newhall and Palmdale P-C regions are nearly adequate for supplying construction aggregate for the existing population of inhabitants and the anticipated population increase by the year 2032. Based on the projected population figures and using an average annual consumption rate of 10.0 tons per capita for the Saugus-Newhall P-C Region, approximately 54 million tons of aggregate will be required to satisfy the local demand, not including the current level of 30 percent exports. Current reserves are adequate to fulfill local 50-year requirements by more than seven fold, provided reserves are made available from each of the three sectors within the Saugus-Newhall P-C Region in order to obtain the proper balance of coarse and fine aggregate for Portland cement concrete.

Of the approximately 54 million tons of aggregate that will be needed to satisfy the local demand about 50 percent of this or 27 million tons will most likely be needed to make Portland cement concrete. About 50 percent of the 27 million tons will be coarse aggregate and a like amount will be fine aggregate.

In the Saugus-Newhall P-C Region, Sector A contains a greater amount of fine aggregate than coarse aggregate, while Sector C is well endowed in coarse material by crushing bedrock; however, sand can be produced in conjunction with the coarse material of Sector C. Sector B contains a reasonable balance between coarse and fine aggregate, but the distribution of aggregate within Sector B is not uniform. Therefore, if measures are to be taken to provide for emergency contingencies or to provide for a draw down of reserves as a result of consumption by the adjacent San Fernando Valley P-C Region, then particular consideration should be given to designating sufficient portions of all three sectors. Current reserves within the Palmdale P-C Region are not adequate for supplying aggregate to that region until the year 2032. Based on the projected population figures and using an average annual consumption rate of 12.2 tons per capita for the Palmdale P-C Region, approximately 122 million tons of aggregate will be needed to meet the local demand. A large percentage of this total is available as current reserves, but some of the resources within Sector D or E would be necessary to fulfill the 50-year need.

Consideration also needs to be given to the advisability of providing sufficient aggregate resources to allow for unforeseen circumstances, such as reconstruction in the wake of a major earthquake or similar disaster. In addition, it can be anticipated that, if residents of the adjacent San Fernando Valley P-C Region fail to find a local source of aggregate to replace their regions rapidly depleting reserves (anticipated to be depleted in about 10 years), they are likely to use more aggregate from the Saugus-Newhall P-C Region to meet much of their requirements. With the substantially higher population in the San Fernando P-C Region (about 2.5 million inhabitants compared to about .08 million inhabitants of the Saugus-Newhall P-C Region) this development could lead to a significantly accelerated depletion rate for the Saugus-Newhall P-C Region.

The Palmdale P-C Region has two sectors (D and E) that contain similar material with a fair balance between coarse and fine aggregate. Sector E is located further from the main urban and nonurbanizing areas of Lancaster-Palmdale than sector D; however, sector E should be given serious consideration as a future aggregate source, to be used as a back-up producer for sector D and as an aggregate source for future development in the vicinity of sector E.

ACKNOWLEDGMENTS

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APPENDIX

Interim Criteria for Sectorization of MRZ-2 Areas for Aggregate

The purpose of sectorizing MRZ-2 areas is to provide a semi-quantified estimate of construction aggregate resources which are likely to be available to satisfy society's needs during the next 50 years. This estimate, when compared to DMG projected needs for the next half century, provides the context for communities to plan for future resource availability in their land-use policies. The determination of sectors is intended for the use of the State Mining and Geology Board in identifying areas which are candidates for designation under SMARA. The development of sectors provides a perception of future mineral resource availability in the face of future needs and also portrays where these available minerals are generally located. This information is distributed by the Board to all affected lead agencies to provide them with the data necessary to plan for future resource availability in their land-use policies.

Areas within MRZ-2 classifications are sectorized if they have current land uses which are similar to those in areas which have had feasible mineral extraction in the past. Areas within MRZ-2 classifications which have generally not been available for surface mining in the past for specified social or economic reasons are not sectorized. Since such areas are unlikely to be used for surface mining during the foreseeable future, their inclusion in estimates of future resource availability would be misleading.

The estimation of future mineral resource availability in sectors is not a precise analysis, but rather is the best general estimate which can be made with the data presently available. Areas within and without sectors can be used for mining or other land uses at the discretion of the local governments which are charged with responsibility for making land-use decisions. Establishment of sectors in no way infringes on this authority. Rather, it provides a perception of future mineral resource availabilities in the face of future needs and also portrays where these available minerals are generally located.

The following criteria will be used by DMG in identifying mineral resource areas which are available for future use. These criteria, in conjunction with the geologic and geometric characteristics of specific mineral deposits will be used in sectorizing MRZ-2 areas. Use of these criteria will assure that sectors contain geologically homogeneous mineral deposits which, based upon current land use, will be available for future use.

These land-use criteria are interim and will be used on a trial basis by DMG to evaluate their usefulness. DMG will provide the Board with formal recommendations concerning these criteria in fiscal year 1983-84.

The following specific land uses are considered to be generally incompatible with mining and will thus be excluded from sectors. Mineral resource areas containing land uses not specifically listed will be considered for sectorization. The criteria are to be applied only to lands classified as MRZ-2.

There are two general categories of exclusion: I. Economic Exclusion, and II. Social Exclusion.

I. Economic Exclusion

Specific excluded land uses are:

1. Residential areas
2. Commercial areas with land improvements (buildings)
3. Industrial areas (buildings and adjacent needed storage and parking facilities)
4. Major public or private engineering projects, including:
 - a. canals
 - b. freeways
 - c. bridges
 - d. airports and associated developments such as parking lots
 - e. dams
 - f. railroads
 - g. major pipelines
 - h. major power transmission lines

II. Social Exclusion

Specific excluded land uses are:

1. Cemeteries
2. Geologic Scientific Zones
3. Public parks, developed historical sites and structures, and public recreation areas of all types
4. Public or private schools, institutions, hospitals, and prisons, including adjacent grounds and related structures
5. Military bases and reservations

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MINERAL LAND CLASSIFICATION OF THE
GREATER LOS ANGELES AREA

SPECIAL REPORT 143 -- PART V
1987

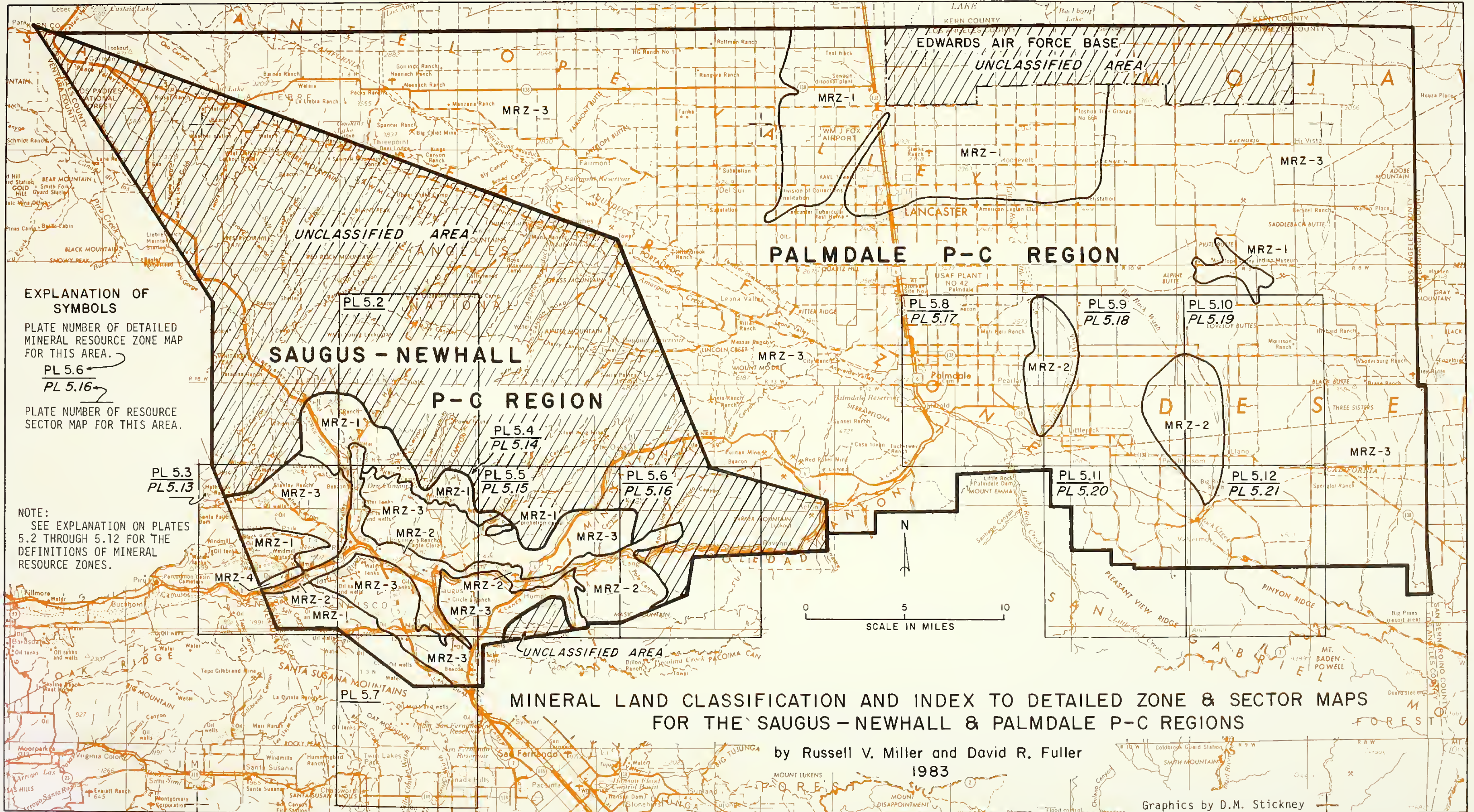


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JAMES F. DAVIS, STATE GEOLOGIST

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THE RESOURCES AGENCY - GORDON K. VAN VLECK, SECRETARY
DEPARTMENT OF CONSERVATION - RANDALL M. WARD, DIRECTOR

SPECIAL REPORT 143, PLATE 5.1

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no. 143
pt. 5



Base map by U.S. Geological Survey



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WARM SPRINGS MOUNTAIN QUADRANGLE

SPECIAL REPORT 143 PLATE 9 2



TOPOGRAPHIC BASE MAP BY U.S. GEOLOGICAL SURVEY
Reduced from 1:24,000

Graphics by D.R. Fuller, R.V. Miller,
and D.H. Stickney.

EXPLANATION

CONTOUR INTERVAL 40 FEET
NATIONAL GEODESIC VERTICAL DATUM OF 1955

- Drill hole
- OUTER BOUNDARY OF AREAS SUBJECT TO URBANIZATION
Boundaries established from data supplied by the Office of Planning and Research with modifications developed from information supplied by local government and other sources. Hachures lie within area undergoing urbanization
- PRODUCTION/CONSUMPTION REGION BOUNDARY
(see text for discussion)
- MINERAL RESOURCE ZONE BOUNDARIES
- SAND & GRAVEL
- MRZ-1 Areas where adequate information indicates that no significant mineral deposits are present, or where it is judged that little likelihood exists for their presence
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- MRZ-4 Areas where available information is inadequate for assignment to any other MRZ zone
- STONE

See text for additional explanation of MRZ Symbols

WARM SPRINGS MOUNTAIN, CALIF

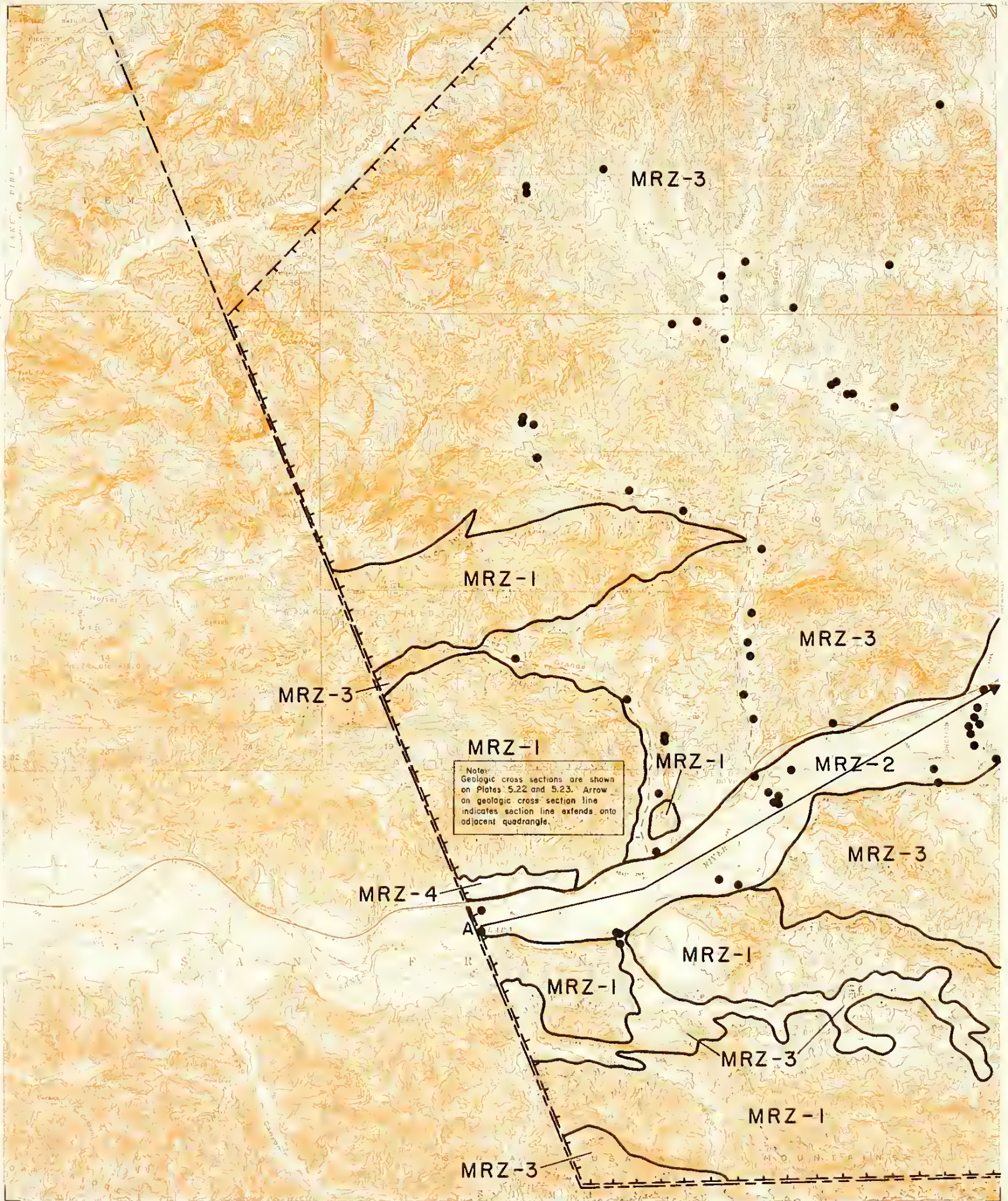
MINERAL LAND CLASSIFICATION MAP
AGGREGATE RESOURCES ONLY

Saugus-Newhall and Palmdale P-C Regions

By S. E. Joseph, S. S. Tan, and R. W. Goodman

PREPARED IN COMPLIANCE WITH THE SURFACE MINING AND
RECLAMATION ACT OF 1975, ARTICLE 4, SECTION 2761

James F. Davis
STATE GEOLOGIST



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EXPLANATION

- Drill hole
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CONTOUR INTERVAL 25 FEET
ELEVATION IN FEET
LITHIC MATERIAL

VAL VERDE CALIF

**MINERAL LAND CLASSIFICATION MAP
AGGREGATE RESOURCES ONLY**

Saugus-Newhall and Palmdale P-C Regions

By S. E. Joseph, S. S. Tan, and R. W. Goodman

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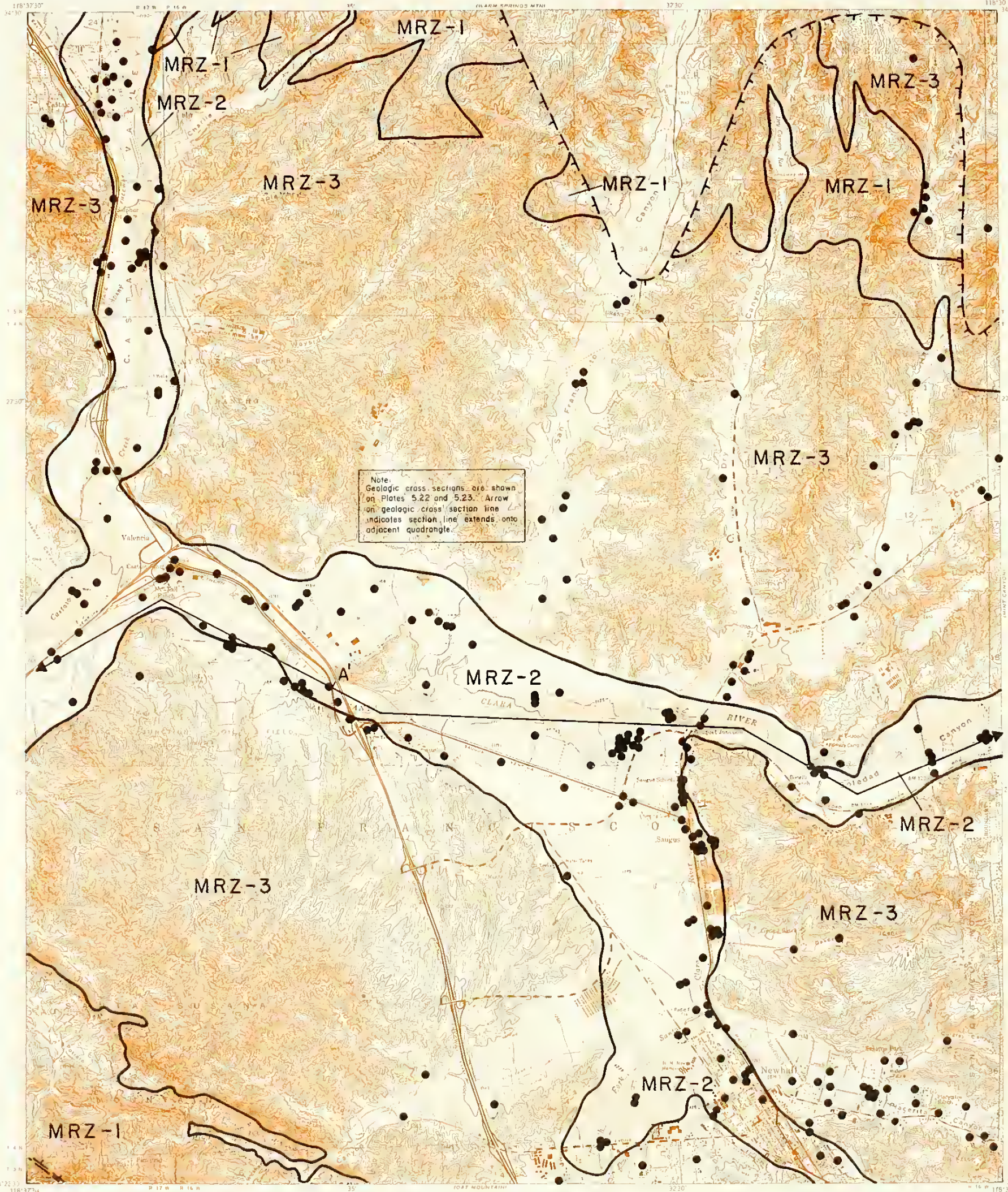
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NEWHALL QUADRANGLE
SPECIAL REPORT 143 PLATE 5.4



Note:
Geologic cross sections are shown
on Plates 5.22 and 5.23. Arrow
on geologic cross section line
indicates section line extends onto
adjacent quadrangle.

TOPOGRAPHIC BASE MAP BY U.S. GEOLOGICAL SURVEY
Reduced from 1:24,000

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EXPLANATION

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CONTOUR INTERVAL 25 FEET
DOTTED LINES REPRESENT 5 FOOT CONTOURS
DASHES IS MEAN SEA LEVEL

**MINERAL LAND CLASSIFICATION MAP
AGGREGATE RESOURCES ONLY**

Saugus-Newhall and Palmdale P-C Regions

By S. E. Joseph, S. S. Tan, and R. W. Goodman

PREPARED IN COMPLIANCE WITH THE SURFACE MINING AND
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James F. Davis
STATE GEOLOGIST

NEWHALL CALIF



TOPOGRAPHIC BASE MAP BY U.S. GEOLOGICAL SURVEY
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EXPLANATION

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 - STONE
- See text for additional explanation of MRZ Symbols.

CONTOUR INTERVAL 40 FEET
DOTTED LINES AS PRESENT ON FOUR CONTOURS
NATIONAL MEAN SEA LEVEL DATUM OF 1929

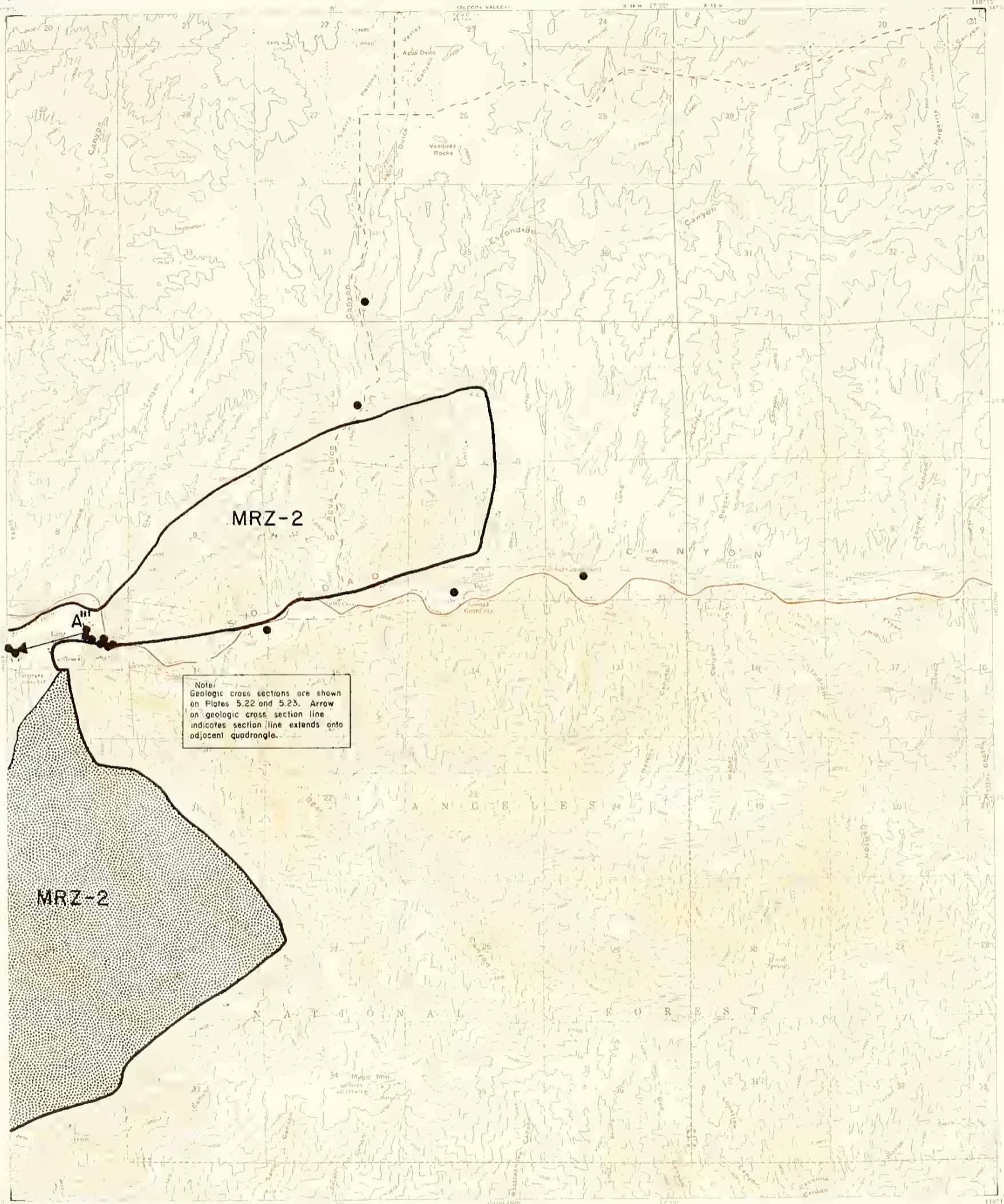
MINERAL LAND CLASSIFICATION MAP
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Saugus-Newhall and Palmdale P-C Regions
By S. E. Joseph, S. S. Tan, and R. W. Goodman

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STATE GEOLOGIST

MINT CANYON, CALIF



Note:
 Geologic cross sections are shown
 on Plates 5.22 and 5.23. Arrow
 on geologic cross section line
 indicates section line extends onto
 adjacent quadrangle.

TOPOGRAPHIC BASE MAP BY U.S. GEOLOGICAL SURVEY
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EXPLANATION

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See text for additional explanation of MRZ Symbols.

CONTOUR INTERVAL 40 FEET
 DOTTED LINES REPRESENT 20-FEET CONTOURS
 NATIONAL GEODESIC VERTICAL DATUM OF 1929

AGUA DULCE, CALIF

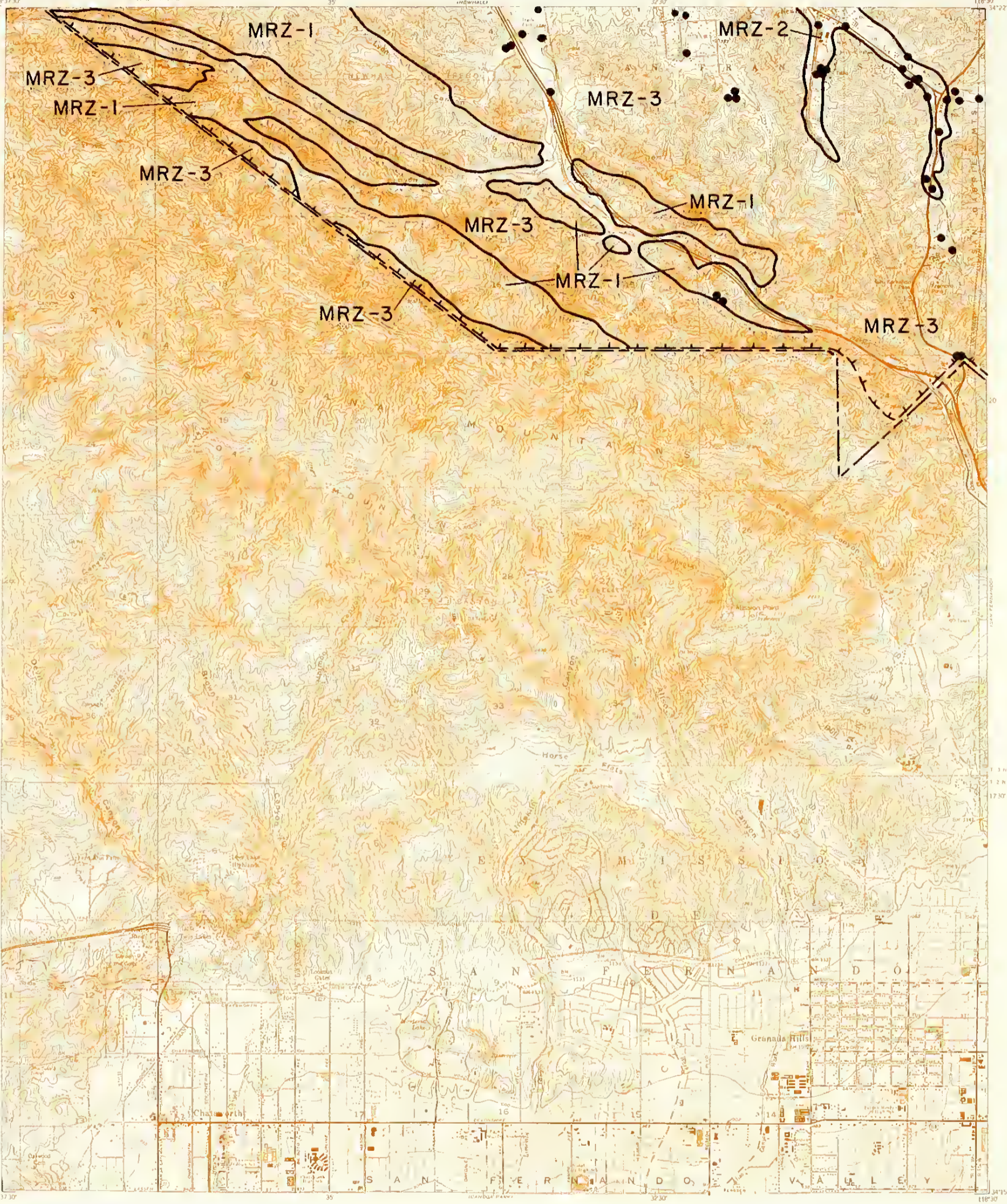
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Saugus-Newhall and Palmdale P-C Regions

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EXPLANATION

- Drill hole
- OUTER BOUNDARY OF AREAS SUBJECT TO URBANIZATION
Boundaries established from data supplied by the Office of Planning and Research with modifications developed from information supplied by local government and other sources. Machures lie within area undergoing urbanization.
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- STONE

See text for additional explanation of MRZ Symbols

CONTOUR INTERVAL: 25 FEET
DOTTED LINES REPRESENT 5 FOOT CONTOURS
DATUM IS MEAN SEA LEVEL

OAT MOUNTAIN, CALIF

MINERAL LAND CLASSIFICATION MAP
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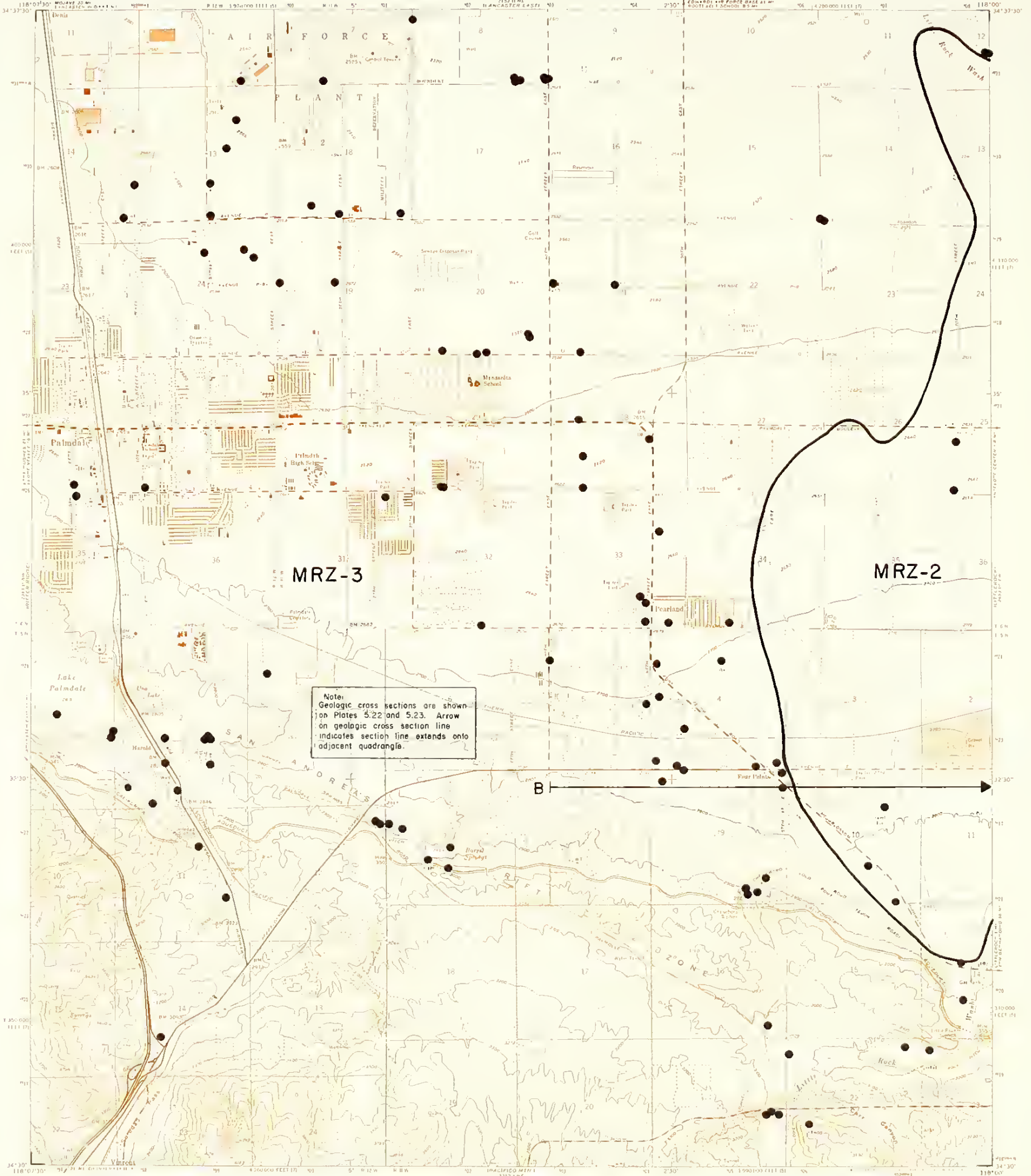
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PALMDALE QUADRANGLE
SPECIAL REPORT 143 PLATE 5.8



Note:
Geologic cross sections are shown
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on geologic cross section line
indicates section line extends onto
adjacent quadrangle.

TOPOGRAPHIC BASE MAP BY U.S. GEOLOGICAL SURVEY
Reduced from 1:24,000

Graphics by D.R. Fuller, R.V. Miller,
C.R. Owens and D.M. Stickney.

EXPLANATION

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See text for additional explanation of MRZ Symbols.

CONTOUR INTERVAL 20 FEET
DOTTED LINES REPRESENT 1000' CONTOURS
NATIONAL GEODETIC VERTICAL DATUM OF 1929

PALMDALE, CALIF

MINERAL LAND CLASSIFICATION MAP
AGGREGATE RESOURCES ONLY

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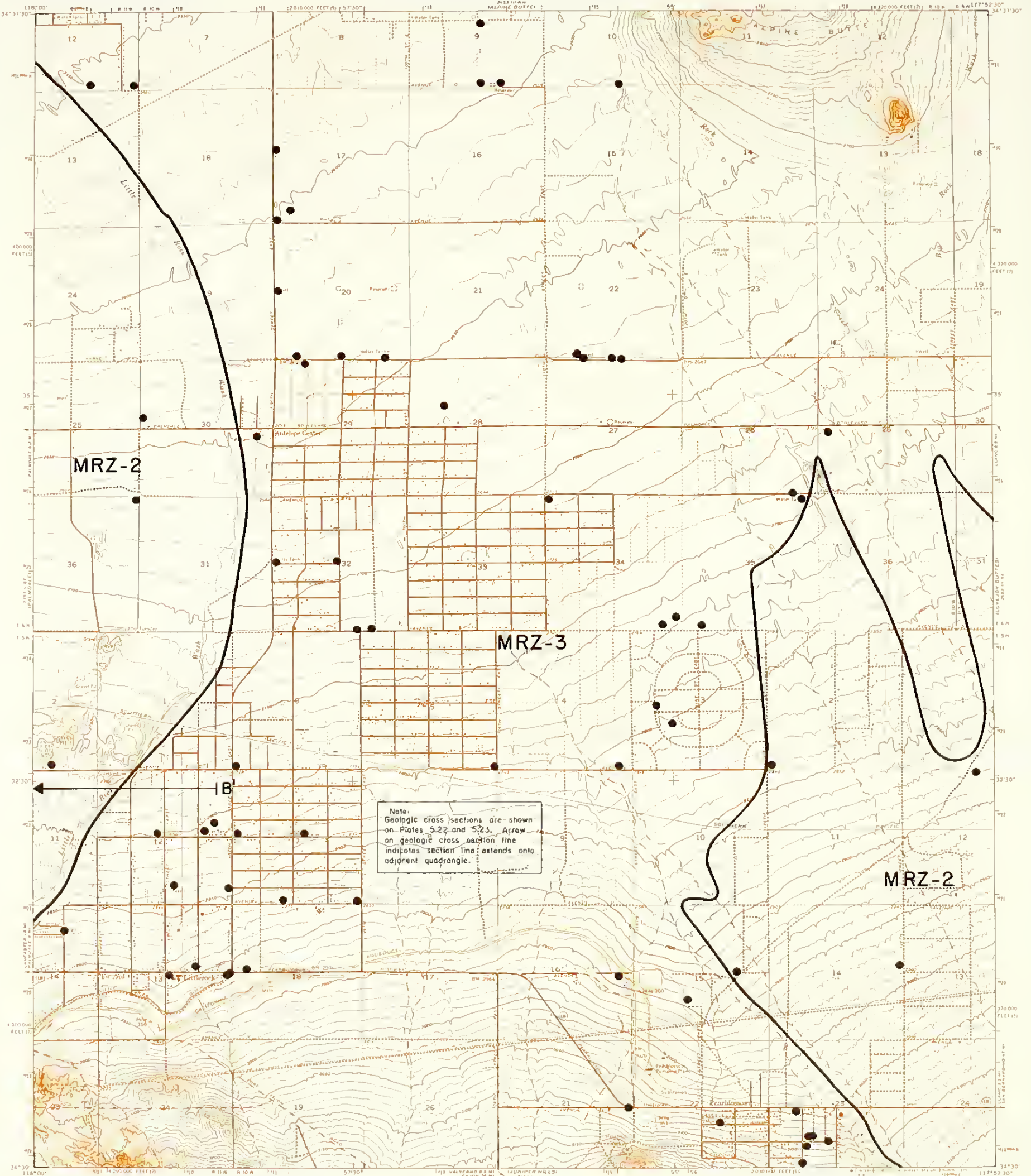
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LITTLEROCK QUADRANGLE
SPECIAL REPORT 143 PLATE 5.9



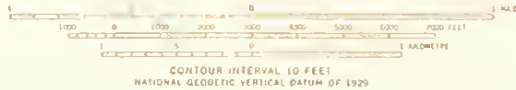
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Reduced from 1:24,000

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- STONE

See text for additional explanation of MRZ Symbols.



LITTLEROCK, CALIF

MINERAL LAND CLASSIFICATION MAP
AGGREGATE RESOURCES ONLY

Saugus-Newhall and Palmdale P-C Regions
By S. E. Joseph, S. S. Tan, and R. W. Goodman

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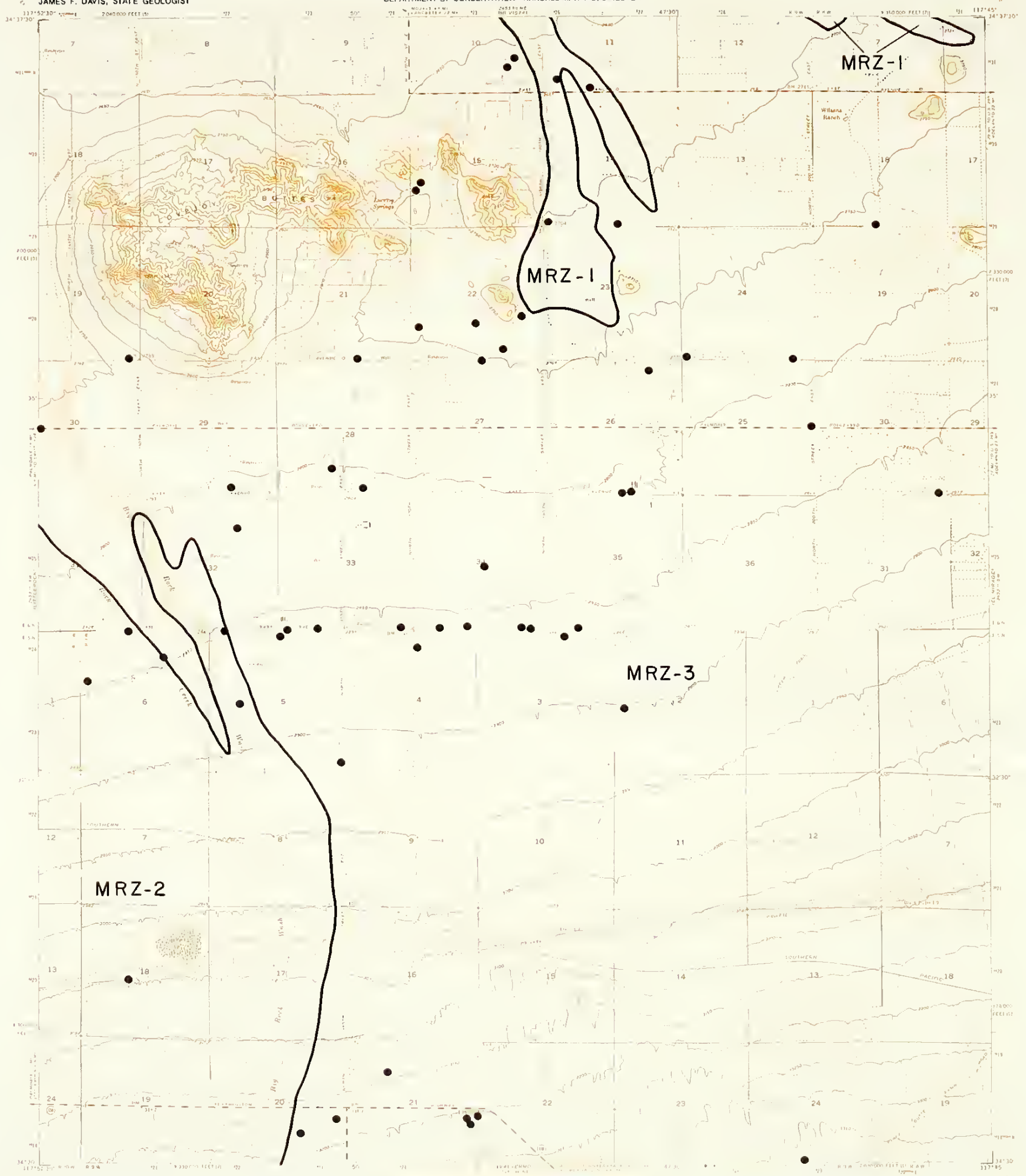
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LOVEJOY BUTTES QUADRANGLE
 SPECIAL REPORT 143 PLATE 5.10



TOPOGRAPHIC BASE MAP BY U.S. GEOLOGICAL SURVEY
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EXPLANATION

- Drill hole
- OUTER BOUNDARY OF AREAS SUBJECT TO URBANIZATION
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See text for additional explanation of MRZ Symbols

CONTOUR INTERVAL 10 FEET
 NATIONAL GEOLOGIC VERTICAL DATUM OF 1929

LOVEJOY BUTTES, CALIF

MINERAL LAND CLASSIFICATION MAP
 AGGREGATE RESOURCES ONLY

Saugus-Newhall and Palmdale P-C Regions
 By S. E. Joseph, S. S. Ton, and R. W. Goodman

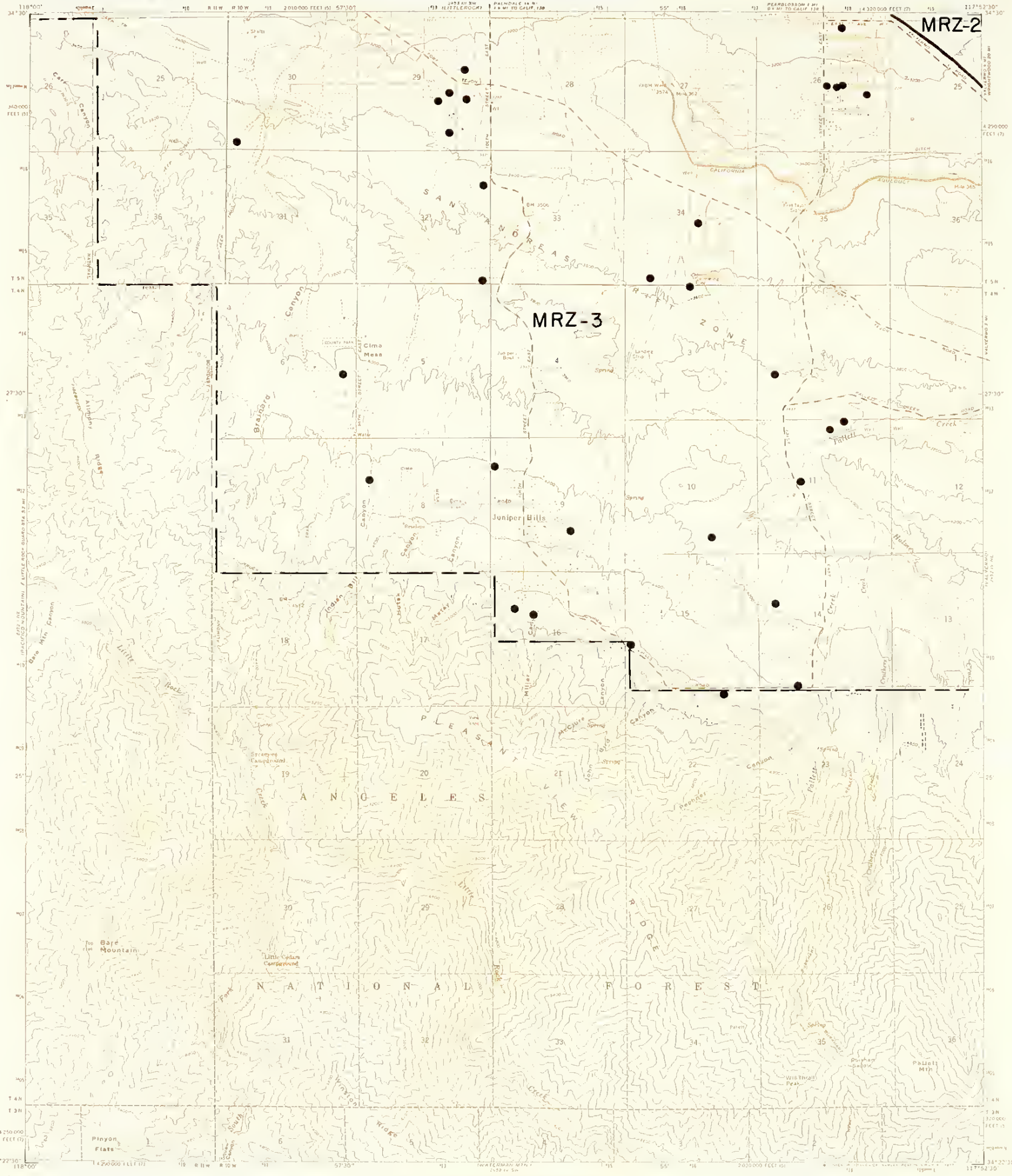
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Graphics by D.R. Fuller, R.V. Miller,
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EXPLANATION

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- SAND & GRAVEL
- MRZ-2
- MRZ-3
- MRZ-4
- STONE

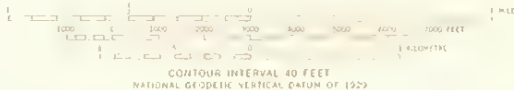
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See text for additional explanation of MRZ Symbols.



JUNIPER HILLS, CALIF.

MINERAL LAND CLASSIFICATION MAP
AGGREGATE RESOURCES ONLY

Saugus-Newhall and Palmdale P-C Regions

By S. E. Joseph, S. S. Tan, and R. W. Goodman

PREPARED IN COMPLIANCE WITH THE SURFACE MINING AND
RECLAMATION ACT OF 1975, ARTICLE 4, SECTION 2761

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VALYERMO QUADRANGLE
SPECIAL REPORT 143 PLATE 5.12

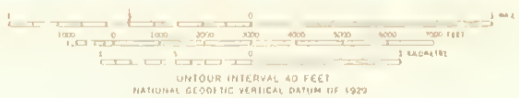


TOPOGRAPHIC BASE MAP BY U.S. GEOLOGICAL SURVEY
Reduced from 1:24,000

Graphics by D.R. Fuller, R.V. Miller,
C.R. Owens and D.M. Stickney.

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(see text for discussion)
 - MINERAL RESOURCE ZONE BOUNDARIES
 - SAND & GRAVEL
 - MRZ-1 Areas where adequate information indicates that no significant mineral deposits are present, or where it is judged that little likelihood exists for their presence.
 - MRZ-2 Areas where adequate information indicates that significant mineral deposits are present, or where it is judged that a high likelihood for their presence exists.
 - MRZ-3 Areas containing mineral deposits the significance of which cannot be evaluated from available data.
 - MRZ-4 Areas where available information is inadequate for assignment to any other MRZ zone.
 - STONE
- See text for additional explanation of MRZ Symbols



VALYERMO, CALIF.

MINERAL LAND CLASSIFICATION MAP
AGGREGATE RESOURCES ONLY

Saugus-Newhall and Palmdale P-C Regions
By S. E. Joseph, S. S. Tan, and R. W. Goodman

PREPARED IN COMPLIANCE WITH THE SURFACE MINING AND RECLAMATION ACT OF 1975, ARTICLE 4, SECTION 2761

James F. Davis
STATE GEOLOGIST



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JAMES F. DAVIS, STATE GEOLOGIST

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VAL VERDE QUADRANGLE
SPECIAL REPORT 143 PLATE 5.13



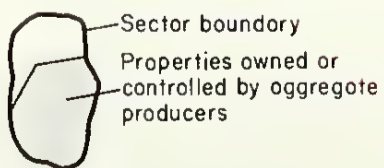
TOPOGRAPHIC BASE MAP REDUCED FROM
U.S. GEOLOGICAL SURVEY ORIGINAL AT
A SCALE OF 1:24,000

Graphics by Dale M. Stickney

1" HORIZONTAL INTERVAL IS FEET
1" VERTICAL INTERVAL IS FEET
1" SCALE UNLESS OTHERWISE NOTED
BY THE MAP USER

VAL VERDE, CALIF

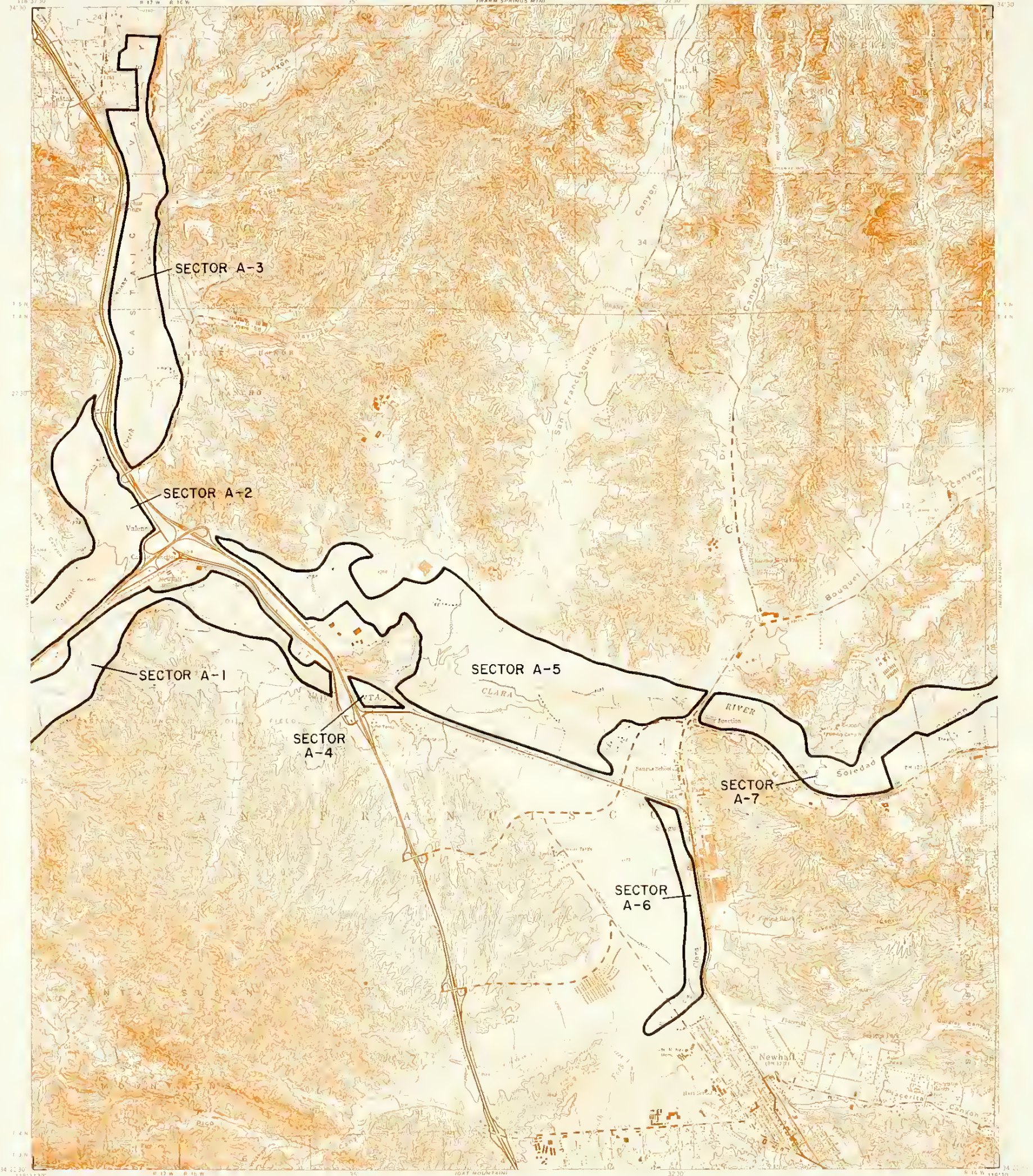
EXPLANATION



AGGREGATE RESOURCE SECTORS
Sauqus-Newhall and Palmdole P-C Regions
By S. E. Joseph, S. S. Ton, and R. W. Goodmon
1983

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STATE GEOLOGIST



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
Graphics by Dale M. Stickney



CONTOUR INTERVAL 25 FEET
DOTTED LINES REPRESENT 5-FOOT CONTOUR INTERVAL
ELEVATION IS MEAN SEA LEVEL

NEWHALL CALIF

EXPLANATION

-  Sector boundary
-  Properties owned or controlled by aggregate producers



AGGREGATE RESOURCE SECTORS
Saugus-Newhall and Palmdale P-C Regions
 By S. E. Joseph, S. S. Ton, and R. W. Goodman
 1983

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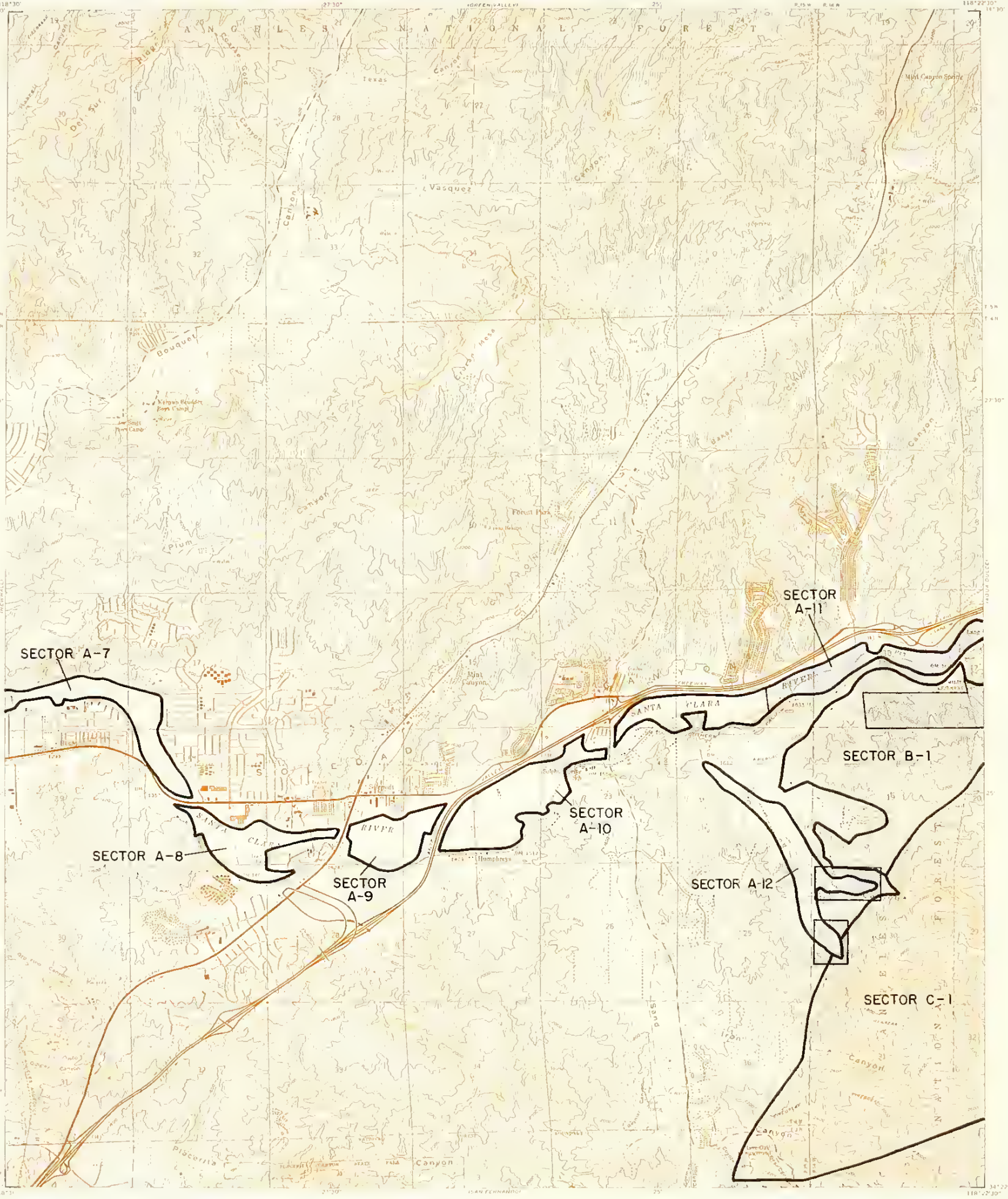
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MINT CANYON QUADRANGLE
SPECIAL REPORT 143 PLATE 5.15



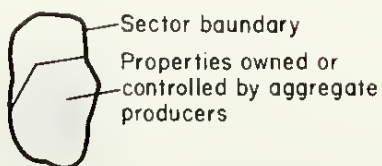
TOPOGRAPHIC BASE MAP REDUCED FROM
U.S. GEOLOGICAL SURVEY ORIGINAL AT
A SCALE OF 1:24,000

Graphics by Dale M. Stickey

CONTOUR INTERVAL 40 FEET
DOTTED LINES REPRESENT 20-FOOT CONTOURS
NATURAL GEODESIC VERTICAL DATUM OF 1929

MINT CANYON, CALIF

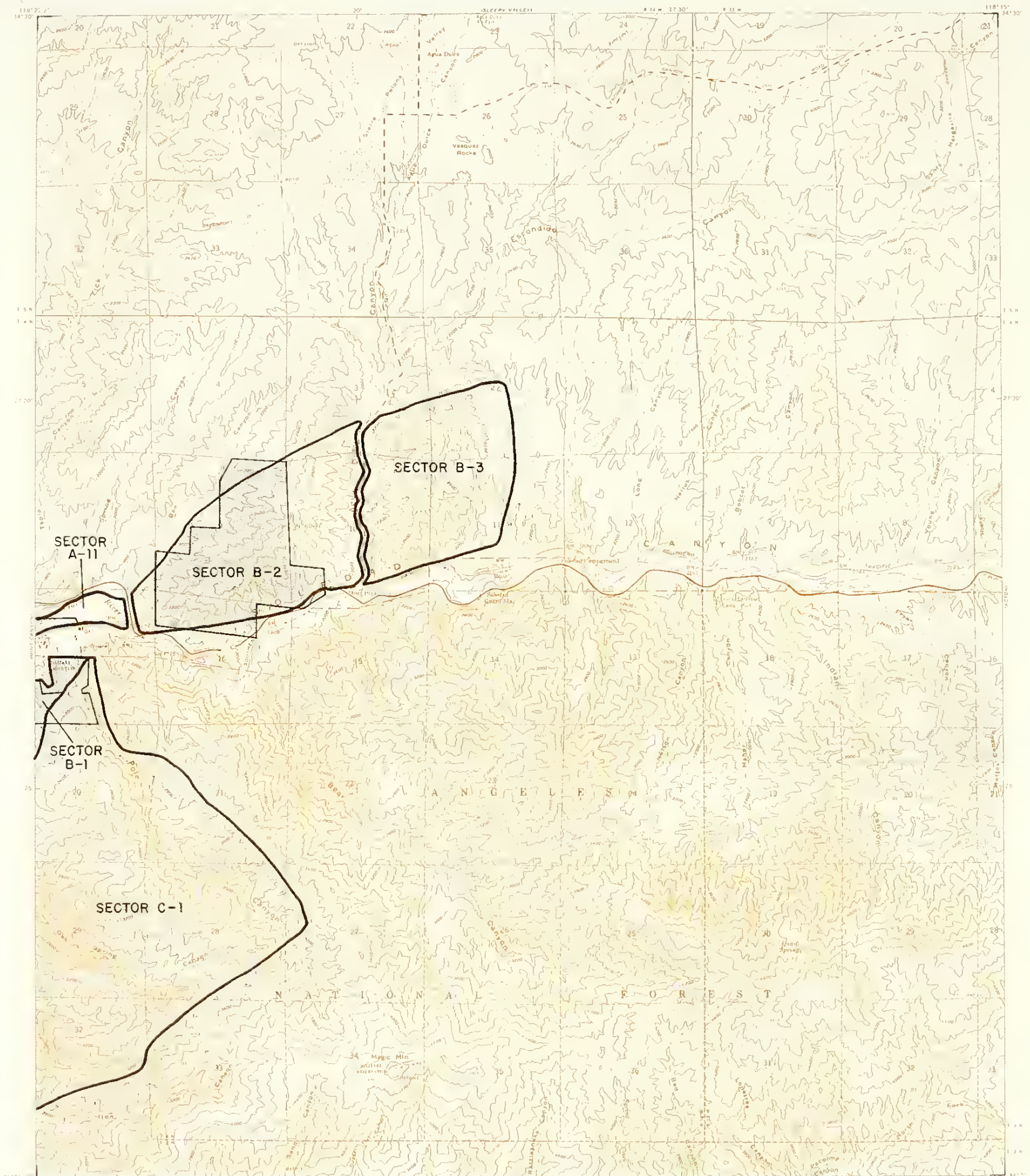
EXPLANATION



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Saugus-Newhall and Palmdale P-C Regions
By S. E. Joseph, S. S. Tan, and R. W. Goodman
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Randall M. Ward
STATE GEOLOGIST





TOPOGRAPHIC BASE MAP REDUCED FROM
U.S. GEOLOGICAL SURVEY ORIGINAL AT
A SCALE OF 1:24,000

Graphics by Dale M. Stickney

CONTOUR INTERVAL 40 FEET
DATE OF THE SURVEY: 1951
NATIONAL GEODESIC SURVEY (GDSN 147)

AGUA DULCE, CALIF

EXPLANATION

-  Sector boundary
-  Properties owned or controlled by aggregate producers



AGGREGATE RESOURCE SECTORS
Saugus-Newhall and Palmdale P-C Regions
 By S. E. Joseph, S. S. Ton, and R. W. Goodmon
 1983

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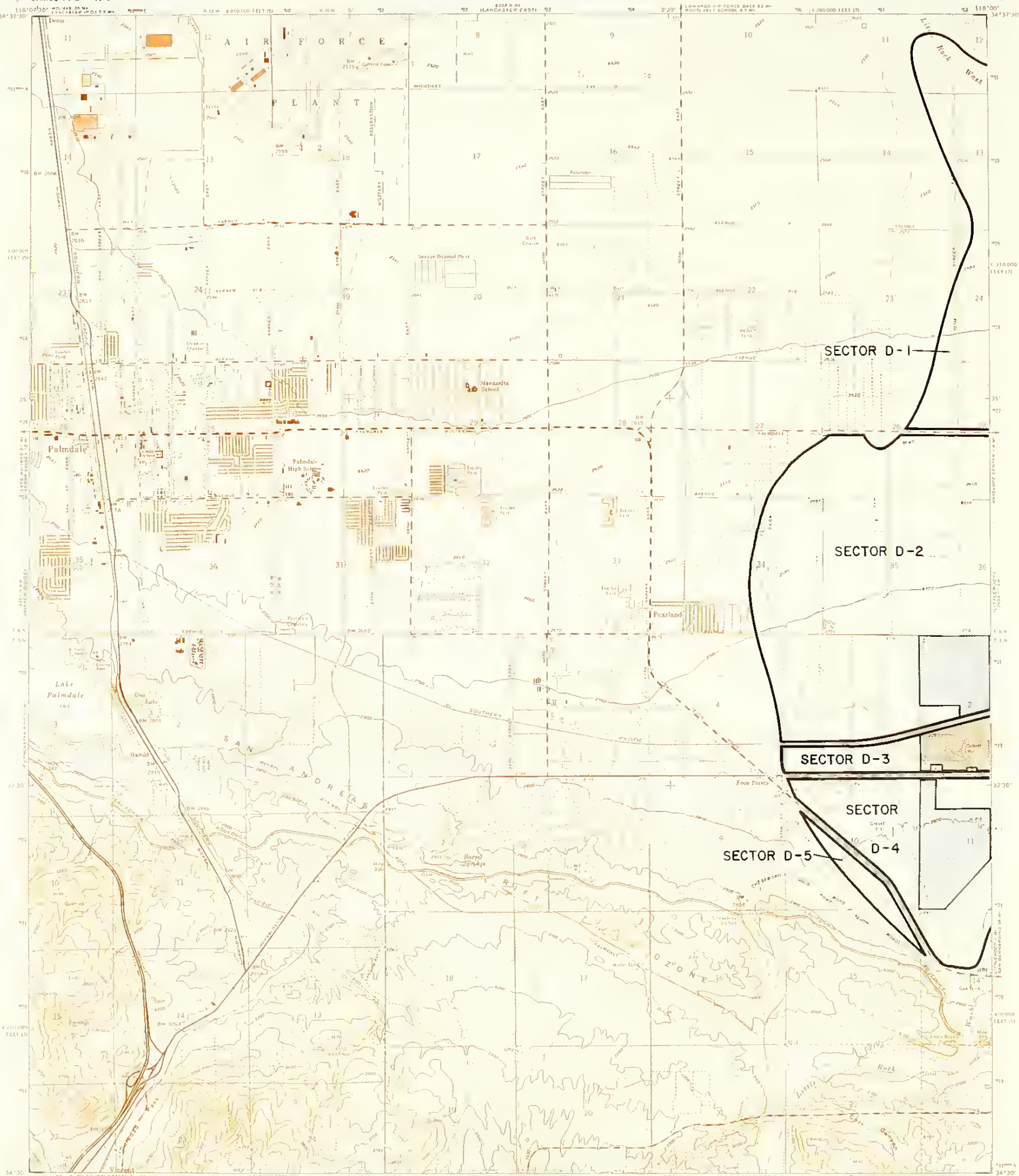
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PALMDALE QUADRANGLE
SPECIAL REPORT 143 PLATE 5.17



TOPOGRAPHIC BASE MAP REDUCED FROM
U.S. GEOLOGICAL SURVEY ORIGINAL AT
A SCALE OF 1:24,000

Graphics by Dale M. Stickney

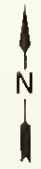


CONTOUR INTERVAL 20 FEET
DOTTED LINE REPRESENTS 100 FOOT CONTOURS
NATIONAL GEODETIC VERTICAL DATUM OF 1929

PALMDALE, CALIF

EXPLANATION

- Sector boundary
- Properties owned or controlled by aggregate producers



AGGREGATE RESOURCE SECTORS
Sougus-Newhall and Palmdale P-C Regions
By S. E. Joseph, S. S. Ton, and R. W. Goodman
1983

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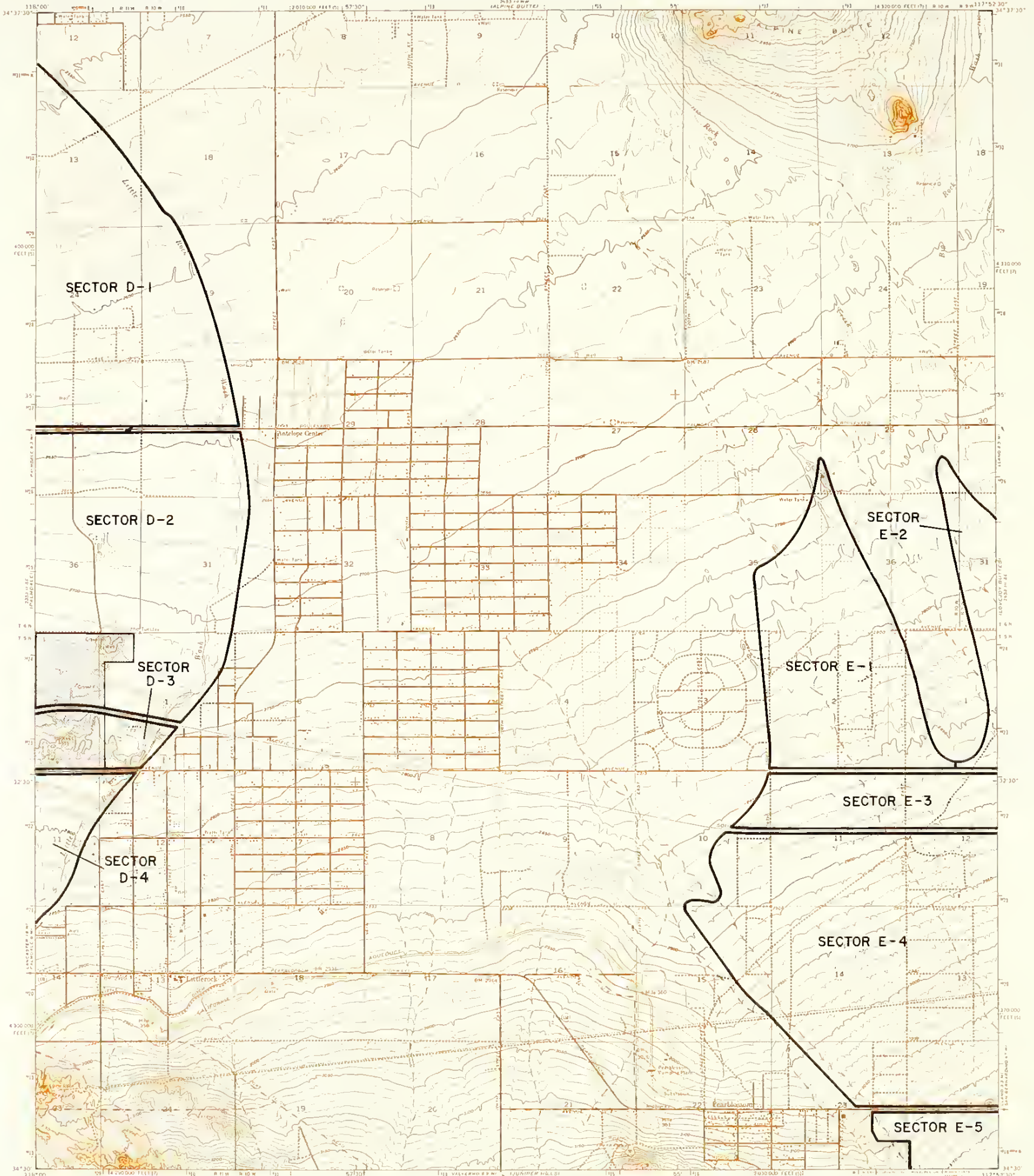
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LITTLEROCK QUADRANGLE
SPECIAL REPORT 143 PLATE 5.18





TOPOGRAPHIC BASE MAP REDUCED FROM
U.S. GEOLOGICAL SURVEY ORIGINAL AT
A SCALE OF 1:24,000



Graphics by Dale M. Stickney

LITTLEROCK, CALIF

EXPLANATION

-  Sector boundary
-  Properties owned or controlled by aggregate producers



AGGREGATE RESOURCE SECTORS
Sougus-Newhall and Polmdole P-C Regions
By S. E. Joseph, S. S. Ton, and R. W. Goodmon
1983

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AND RECLAMATION ACT OF 1975, ARTICLE 4, SECTION 2761

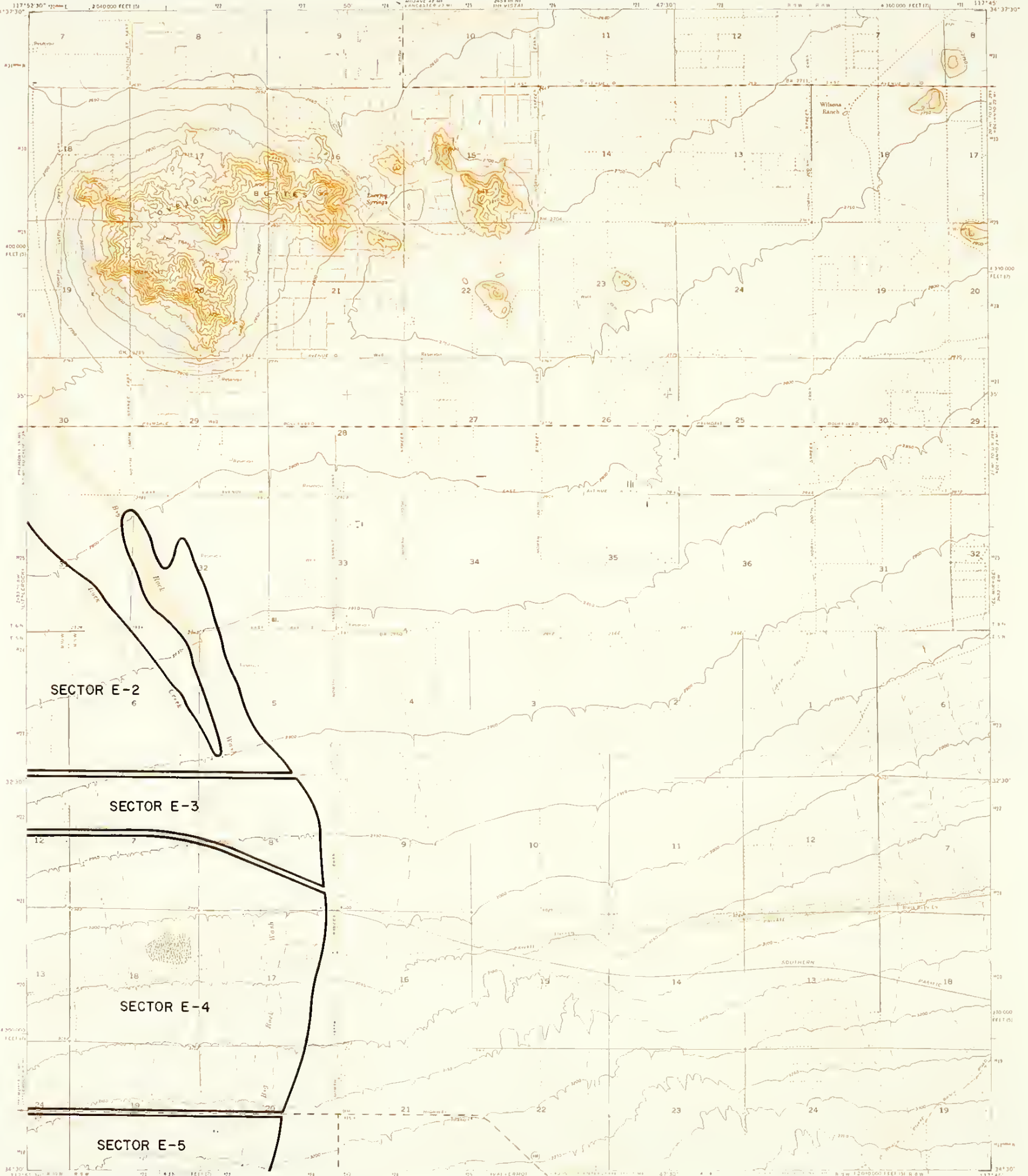
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LOVEJOY BUTTES QUADRANGLE
SPECIAL REPORT 143 PLATE 5.19



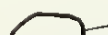
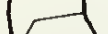
TOPOGRAPHIC BASE MAP REDUCED FROM
U.S. GEOLOGICAL SURVEY ORIGINAL AT
A SCALE OF 1:24,000

Graphics by Dale M. Stickney

CONTOUR INTERVAL 30 FEET
NATIONAL GEODESIC SURVEY DATUM OF 1929

LOVEJOY BUTTES, CALIF.

EXPLANATION

-  Sector boundary
-  Properties owned or controlled by aggregate producers

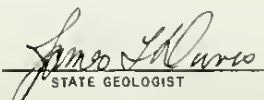


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Saugus-Newhall and Palmdale P-C Regions

By S. E. Joseph, S. S. Tan, and R. W. Goodman
1983

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AND RECLAMATION ACT OF 1975, ARTICLE 4, SECTION 2761

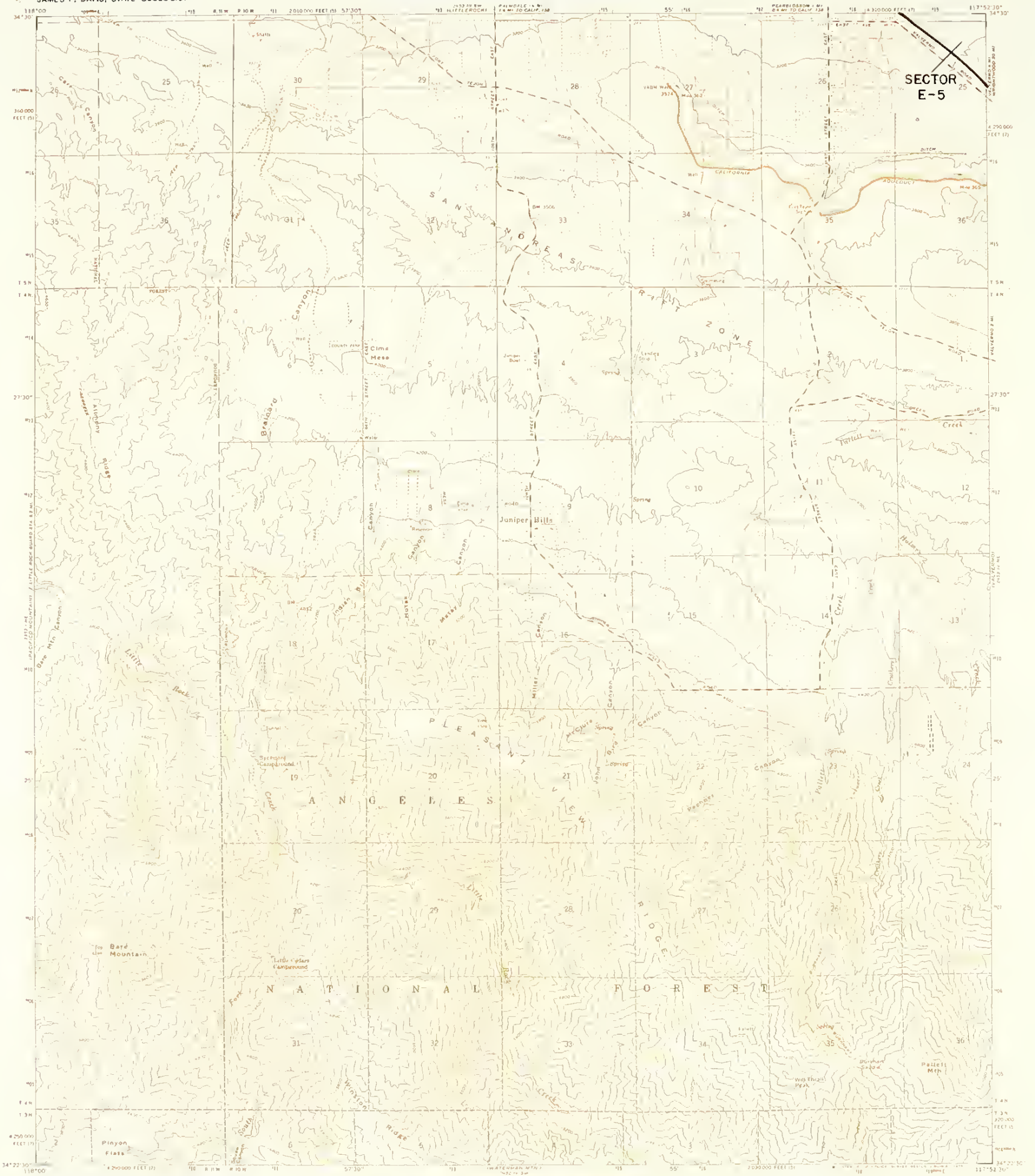

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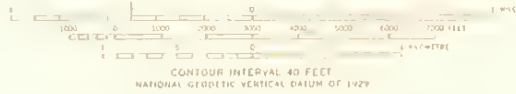
JUNIPER HILLS QUADRANGLE
SPECIAL REPORT 143 PLATE 5.20



SECTOR
E-5

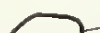

TOPOGRAPHIC BASE MAP REDUCED FROM
U.S. GEOLOGICAL SURVEY ORIGINAL AT
A SCALE OF 1:24,000

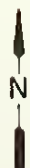
Graphics by Dale M. Stickney



JUNIPER HILLS, CALIF.

EXPLANATION

-  Sector boundary
-  Properties owned or controlled by aggregate producers



AGGREGATE RESOURCE SECTORS
 Saugus-Newhall and Palmdale P-C Regions
 By S. E. Joseph, S. S. Ton, and R. W. Goodmon
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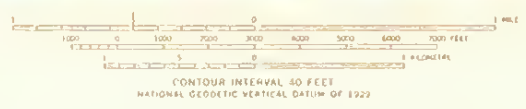
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VALYERMO QUADRANGLE
SPECIAL REPORT 143 PLATE 5.21





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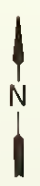


Graphics by Dale M. Stickney

VALYERMO, CALIF.

EXPLANATION

-  Sector boundary
-  Properties owned or controlled by aggregate producers

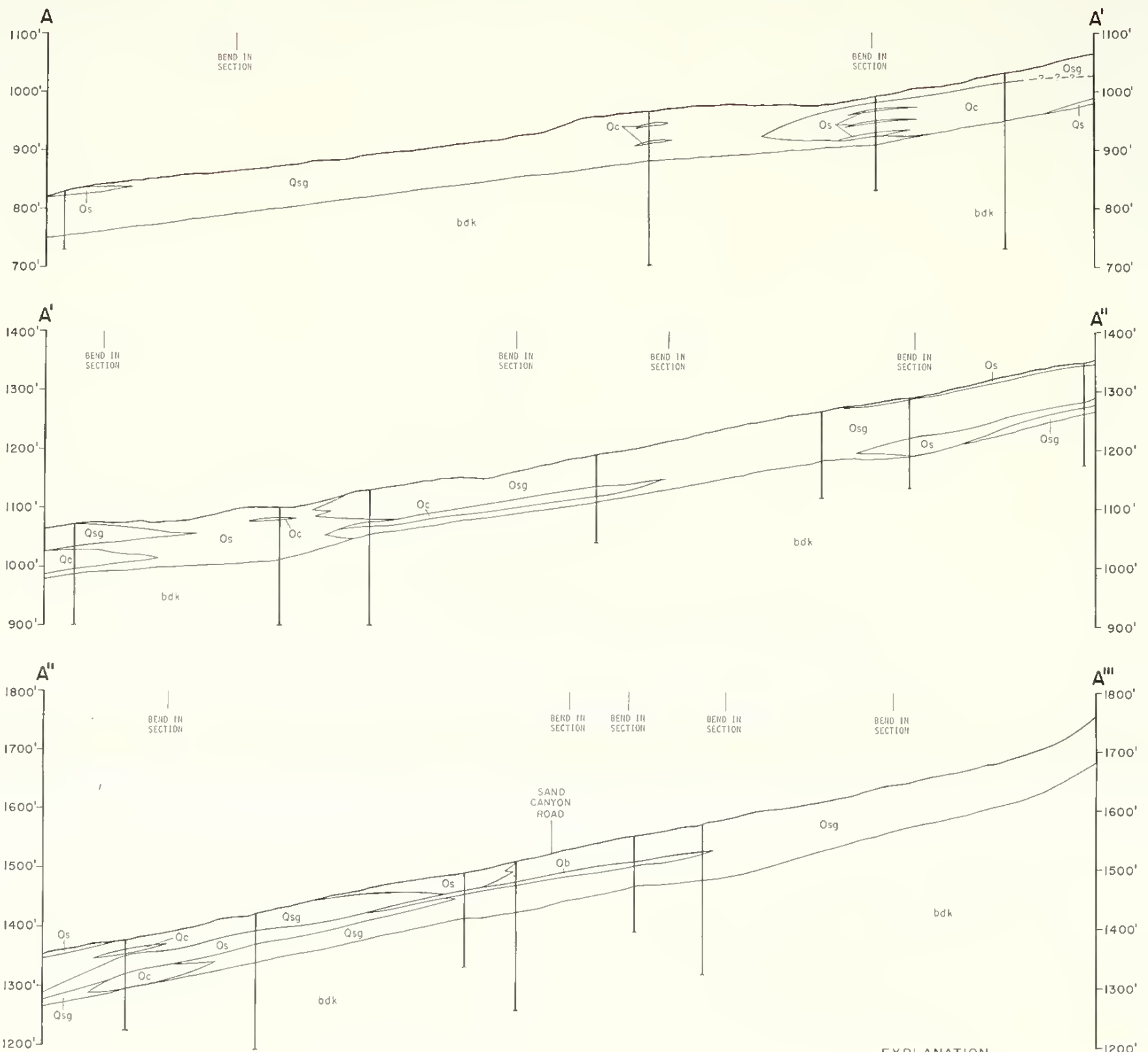


AGGREGATE RESOURCE SECTORS
Saugus-Newhall and Palmdale P-C Regions
By S. E. Joseph, S. S. Ton, and R. W. Goodmon
1983

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AND RECLAMATION ACT OF 1975, ARTICLE 4, SECTION 2761

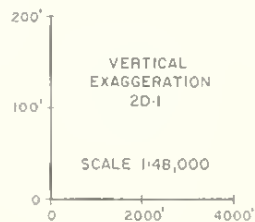
James F. Davis
STATE GEOLOGIST

TN 34 C3 A33 No. 143 Pt. 5



NOTE:

Refer to Plates 5.3, 5.4, 5.5, and 5.6 for location of section lines.



EXPLANATION

QUATERNARY	Qsg	Ob	Os	Oc
	Sand and Gravel	Boulders	Sand	Clay
PRE-QUATERNARY	bdk			
	Bedrock			

SYMBOLS

Contact: dashed where inferred, queried where conjectural.
 Drill holes: wavy line indicates hole bottom extends below depth of cross section limit.

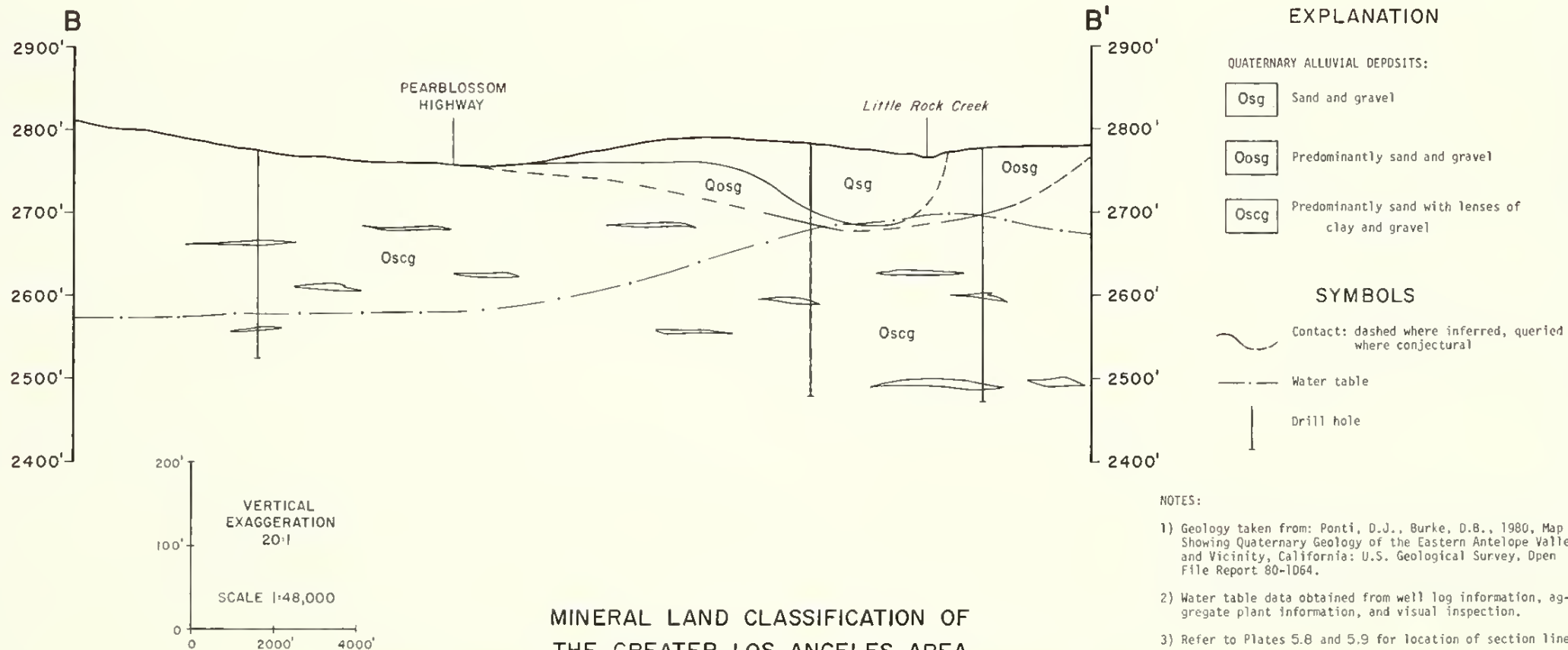
Graphics by C. R. Owens



MINERAL LAND CLASSIFICATION OF THE GREATER LOS ANGELES AREA
 SAUGUS-NEWHALL-PALMDALE PRODUCTION CONSUMPTION REGION
 GENERALIZED GEOLOGIC CROSS SECTION A-A', A'-A'', A''-A''', SANTA CLARA RIVER

By R. W. Goodmon
 1983

Handwritten notes: R.W. Goodmon, 10/10/83, Pt. 5



VERTICAL EXAGGERATION 20:1
 SCALE 1:48,000

MINERAL LAND CLASSIFICATION OF
 THE GREATER LOS ANGELES AREA
 SAUGUS-NEWHALL-PALMDALE PRODUCTION CONSUMPTION REGION
GENERALIZED GEOLOGIC CROSS SECTION B-B', LITTLEROCK CREEK FAN

By R. W. Goodman
 1983

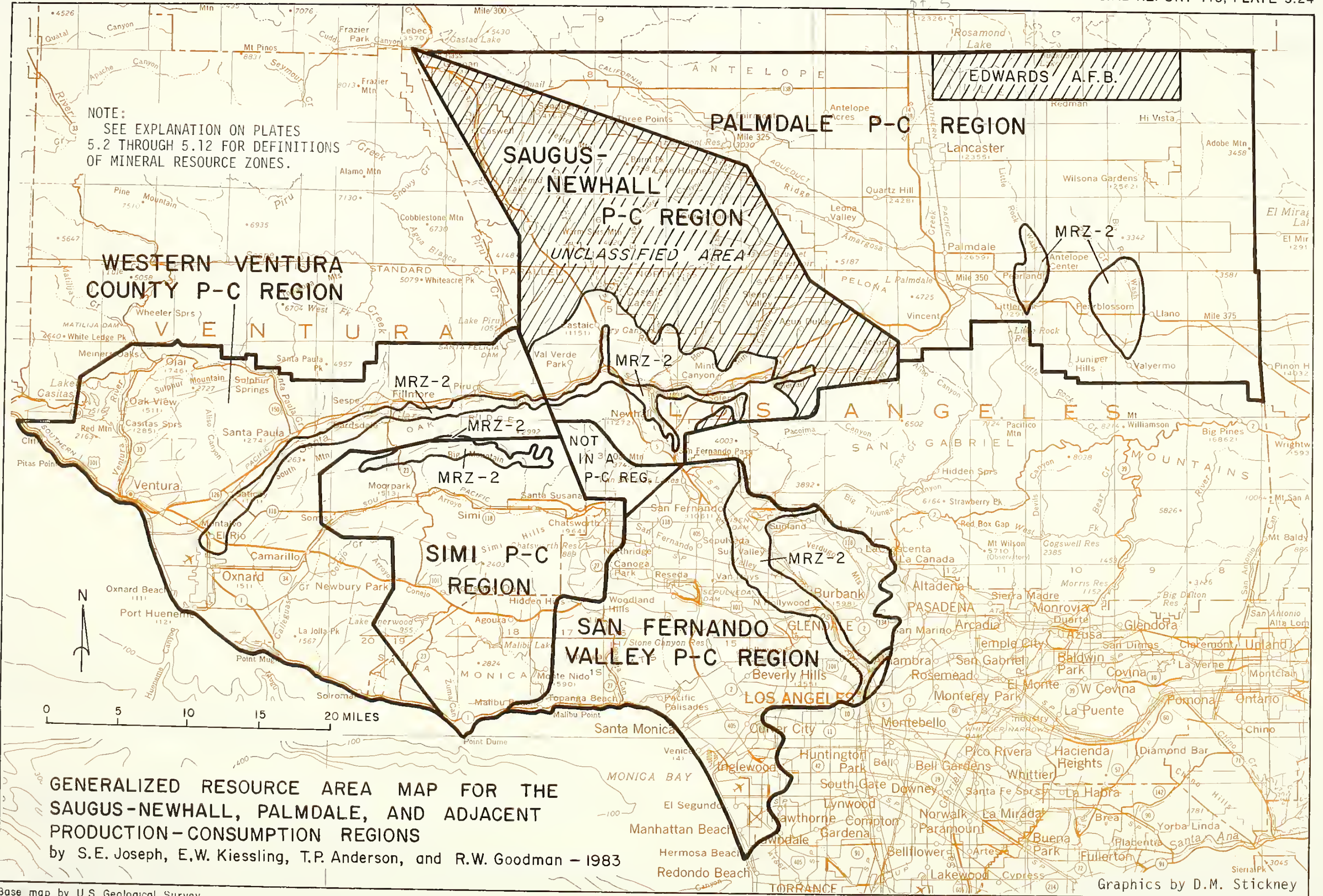


Graphics by C.R Owens

PSL
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 A23
 no. 143
 pt. 5



PSL
TN
24
C3
A33
no. 143
pt 5



NOTE:
SEE EXPLANATION ON PLATES
5.2 THROUGH 5.12 FOR DEFINITIONS
OF MINERAL RESOURCE ZONES.

GENERALIZED RESOURCE AREA MAP FOR THE
SAUGUS-NEWHALL, PALMDALE, AND ADJACENT
PRODUCTION-CONSUMPTION REGIONS
by S.E. Joseph, E.W. Kiessling, T.P. Anderson, and R.W. Goodman - 1983

Base map by U.S. Geological Survey

Graphics by D.M. Stickney

